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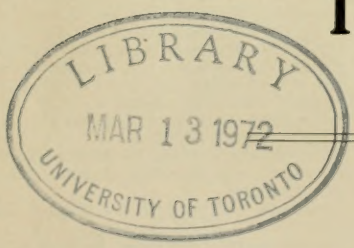

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W. W. WELLS

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The Absorption of Nitrogen by Aluminum.

The properties of aluminum are in many ways diametrically different from other metals. It has many peculiar properties, some of which are not yet understood. Among these properties is one not generally known, and that is the absorption of nitrogen. There is no doubt that this absorption of nitrogen greatly influences the properties of cast aluminum, and from the knowledge that we now possess, it is also probable that it has a bad effect on the metal. To what degree it influences it, is now unknown, but it is believed it is responsible for blowholes and a reduction in tensile strength.

The absorption of nitrogen gas from the atmosphere may be readily appreciated if a mass of aluminum skimmings be wet down with water. Within a short time, the mass will smell strongly of ammonia, showing that the water has been decomposed by the aluminum and formed ammonia from the nitrogen in it. The ammonia will become quite strong under certain conditions and indicates that the absorption of the nitrogen must be considerable.

In melting aluminum it is not customary to use any covering such as charcoal. This practice exposes the molten aluminum to the action of the air so that it has ample opportunity to absorb the nitrogen; and it has been found that the absorption of nitrogen is much greater if the aluminum is allowed to become quite hot. In running down aluminum skimmings, the aluminum becomes much hotter than in the melting of the metal for pouring

into castings, and it will always be found that the mass resulting from the melting of the skimmings (oxide of aluminum mixed with small aluminum shot) will give off more ammonia when wet than other kinds of skimmings. The fact remains, however, that aluminum absorbs nitrogen when melted, and that the hotter it becomes the greater the absorption.

In melting aluminum, it has been known that overheating will injure it, but it generally has been supposed that the oxidation is the cause. The nitrogen absorption, however, is one of the causes for the injury as well as the oxidation, and it may be that it is the principal one although investigations on the subject have not been made.

What the Breaking of the Gate in the Mold Means.

Experienced molders always know what the breaking of the gate in a mold before dumping means. It always indicates, in brass or bronze, that the metal is not good and that it contains impurities which render it red-short. By the breaking of the gate in the mold is meant that it breaks or cracks itself while cooling. In good metal, it remains firm so that when the mold is dumped, the castings, gate and runner are solid.

There are several elements that will cause red-shortness in brass or bronze, but sulphur is the principal one. As it causes red-shortness in iron or steel, so it produces the same result in the copper alloys.

Sulphur is very readily introduced into bronze or brass by the fuel, and especially when coke or coal, instead of charcoal, is used as the covering for the metal in the crucible. These fuels always contain more or less sulphur which is introduced into the metal to a greater or less extent. Charcoal, however, contains no sulphur and this is why it is so good a covering for molten metals.

If molders are experiencing difficulty from bad castings and the reason is not clear, let it be noticed whether the gate cracks in the mold, and if so look for the presence of sulphur in the metal. It has been found to be the cause of some of the difficulties encountered in the brass foundry.

Warming Plating Solutions in the Winter.

During the cold weather, platers are apt to have considerable difficulty in obtaining a good deposit in as rapid a manner as can be produced in the summer months. This fact applies to all solutions, although some are affected by the cold to a greater degree than others.

Many plating rooms are placed in exposed positions or are supplied with little heat so that the solutions often become quite cold. This is especially true on Monday morning when the temperature of the shop drops to a low degree over Sunday. It is not infrequent to find the temperature of the plating solutions, under such circumstances, down below the freezing point of water, and were it not for the salts in them, they would freeze solid. In such extreme cases, it is often impossible to do any plating at all, and the only recourse is to warm them up.

No plating solution works well when the temperature is down to 30 or 40 degrees F. The best results are always obtained by maintaining them at an even temperature all the year round, and about 70 degrees F. is good for solutions that are to be run "cold." All tanks should be provided with a steam-pipe or steam-coil in order to warm the solutions whenever it may be necessary.

During cold weather it is well to use a thermometer and test the temperature of plating solutions when it is suspected that they may be too cold. In extreme cases, however, it is hardly necessary as one's own sense of feeilng will indicate that the temperature is too low. Plating solutions that are too cold deposit metal very slowly and do not "throw" well. Cyanide copper and brass solutions are affected more by the cold than silver or acid copper solutions. Nickel solutions are affected considerably although not as much as cyanide copper or brass solutions. The cold, however, influences all solutions, and if difficulty is experienced in plating during the winter months, see that the temperature is raised to about 70 degrees and then, if they still are a source of trouble, it will be certain that the difficulty is not on account of a cold solution. It may be said, however, that many of the difficulties experienced in the winter months, are caused by the use of too cold a solution. The remedy, of course, is exceedingly simple.

American Practice in Casting Brass for Rolling; A Description of the Methods Now Used in the Casting Shops of the Leading Brass Rolling Mills.

By Erwin S. Sperry.

As rolled brass has its beginning in the casting shop, this department of the brass rolling mill is an exceedingly important one and too much attention cannot be paid to it. It has been said that the casting shop is the "root of all evil" in the manufacture of brass, and the saying is not far from the truth. If the brass is not properly cast, subsequent operations can never change its character, and it will still be imperfect when it reaches the customer. Some of the facts may be concealed, but not all. The fact remains, however, that unless the cast brass is good, no subsequent treatment can change its character.

The casting shop as it exists to-day is practically that of fifty years ago. No part of a brass rolling mill has progressed so little. The rolling mill is constantly being improved by new devices for the rapid and successful rolling of the brass, new machines are frequently being introduced for the final finishing of the sheet, and even the annealing furnaces have undergone considerable development. The casting shop, however, seems to have remained still. While little or no progress has been made in the casting of brass, it can scarcely be called a reflection upon the industry itself, for the reason that

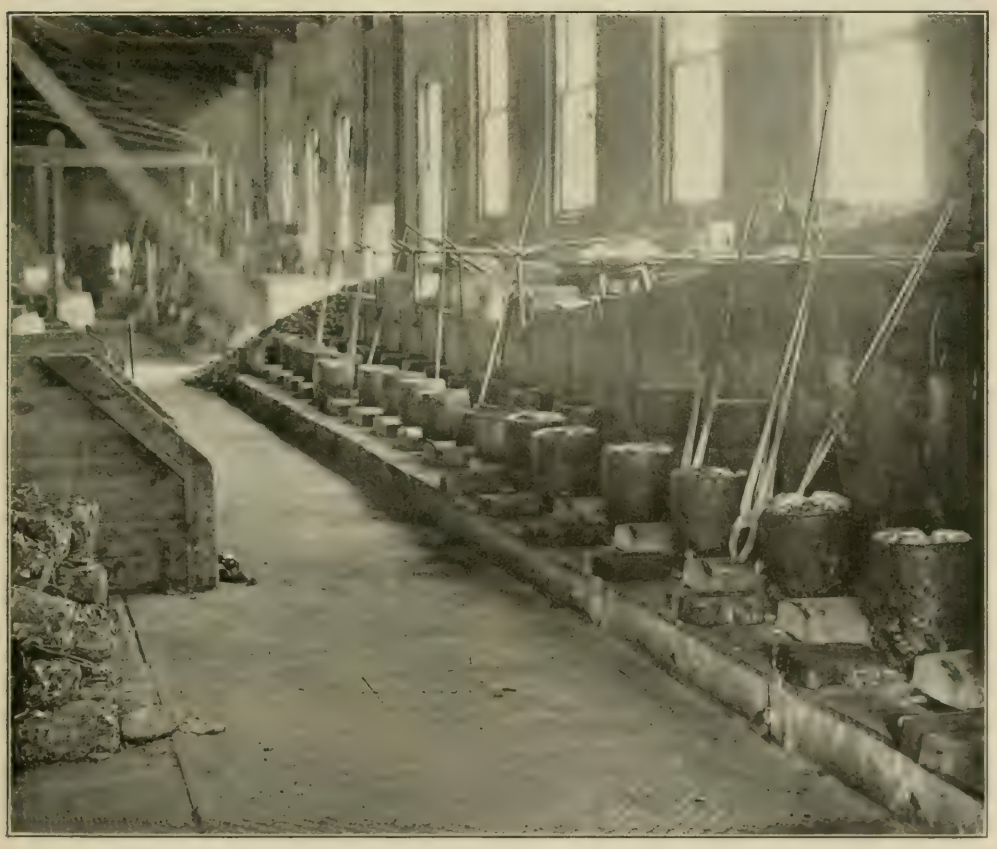


Fig. 1. Type of the Casting Shop in American Brass Rolling Mills, Showing Furnaces and Crucibles. Metal is on the Furnace Ready for Starting in the Morning. Covers Slide Back in Opening the Furnaces.

there is sufficient competition in the manufacture of rolled brass to stimulate inventive capacity. It seems to have been simply impossible to make any decided improvement in the art of casting the brass, and in this respect, it is a satisfaction to know that the United States is as far ahead as any nation in the matter, and even in England, where the man-

Fig. 2. Type of Graphite Crucible Used. The Lid is Seldom Used.

ufacture of rolled metal was carried on for several hundred years before it was commenced in our own country, no greater progress has been made.

The Casting Shop Itself.

The American casting shop as now built consists of a fire proof building of height enough to allow the smoke to rise out of the way. The roof is usually made of corrugated iron and ample ventilation is provided by the employment of large ventilators in the top. The old casting shop with its low roof has almost passed out of existence. Large and numerous windows are provided at the sides to supply ample light. The walls of the shop are usually built of brick.

The furnaces are built in rows and lead into a common flue which in turn leads into a chimney. The chimney used is almost exclusively of brick and square in cross section. Some mills use round chimneys of brick, but the matter is one of individual idea. The square chimney is the more common. The height of the chimney is of importance as natural draft only is used and one too low will not produce the desired results. A chimney from 75 to 100 feet is generally used and has been found to give the necessary draft even in unfavorable weather.

In the center of the casting shop is a pit, built up from brick or stone and used for holding long molds. The object of the pit is to allow the top of a long mold to come to a suitable height for pouring. Wide brass or similar short molds are poured directly on the floor without the necessity of using the pit.

The floor of the casting shop is always made of large cast-iron floor plates, with diagonal V shaped grooves in them to prevent them from becoming smooth when worn. The cast-iron floor plate has been found to be the most satisfactory and serviceable floor known. It is easily kept clean (and much

Fig. 3. Appearance of Crucible When it is No Longer Useful.

metal thus saved) and is not affected by heat like concrete or brick. The latter materials soon become a source of trouble although good when new.

The Furnaces.

The common practice in the American brass rolling mill is to use anthracite coal for fuel. Practically all the mills use it. Oil is beginning to be used in some mills, but up to the present it has not made much headway.

One of the largest mills, however, has begun to look with favor upon it and has installed a number of oil furnaces which seem to be giving excellent results. Some of the other mills have installed oil furnaces for special work, but the greater part of the brass for rolling is now melted with coal. It is probable, however, that the future will see oil more extensively used than at present. Coke is not used at all. The use of anthracite coal is attended with the good feature that the fire does not burn out as readily as it would were coke employed, and this is quite an important feature as will be subsequently explained.

Natural draft only is used in the furnaces. The employment of forced draft has never been practiced to any extent as it has been found unnecessary. With a number of furnaces running and a good, high chimney, there is no need of it. One brass caster runs from 8 to 10 fires, and is attended by one or two helpers. One is usually all that is required. The helper looks after the fires to some extent, and attends to the molds. Other employees wheel coal and remove the cast brass. The fires are all started at the same time and the metal is all charged into the crucibles as fast as can be done after the coal has been placed around them. As a usual rule, the brass is all ready for pouring at about the same time. When all the metal has been put into the crucible and the right heat has been obtained, the covers of the furnaces are pushed off in order to prevent overheating of the brass and the accompanying loss of spelter. It is at this stage that the anthracite coal is of value. With the covers of the furnace off, coke would soon burn away so that by the time the last pot of metal was to be poured, the fire would have died out to such an extent that the metal would probably be solid. In other words, the anthracite coal enables the caster to "hold his heats" so that the last pot of metal is at the right heat when poured. In pouring, the pots are poured one after another and then replaced in the furnaces again for another heat. The advantage of coal over coke will thus be seen.

The furnaces in the American casting shop are with few exceptions made square. A few mills use round furnaces, but the large majority employ square ones. The square furnaces seem to be the favorite. I will not attempt to say whether the round or the square furnace is preferable, as this has always been a matter of opinion. Each has special advantages, however, and the fact that square furnaces are more extensively employed, indicates that they are considered more desirable. They have the particular feature that ordinary shapes of fire brick are used, and that the furnaces are easily built or repaired. Built as they are, in a compact form, loss of heat by radiation is also reduced to the minimum.

The furnaces, as will be noticed in Fig. 1, are raised a few inches from the floor, in order to make it easy for the caster. The fronts and tops of the furnaces are also well protected and stayed by iron plates and buckstays, so that there will be no forcing out of shape by the heat. A brick high in alumina or one, it may be said, of a somewhat basic nature has been found quite suitable for the furnaces for the reason that clinkers do not adhere or cling to them as readily as one of an acid character. The ash of coal, of course, is basic and this is the reason for using a fire brick of a basic nature. At the same time, it should be hard in order to stand the abrasion.

The Metal.

Electrolytic copper is used for the greater proportion of brass mixtures, and for the best grades of spinning, drawing or cartridge metal Lake Superior copper is employed. The spelter employed is usually a Prime Western grade for ordinary brass, an intermediate grade comparatively low in lead for better grades while for the best grades above mentioned, the purest spelter obtainable is used. For German-silver, this grade of spelter and Lake copper are employed. Electrolytic copper is now used much more extensively than formerly on account of its increased purity and uniformity.

Crucibles.

It is customary to use crucibles in the brass rolling mill industry for brass melting, and this may be called universal practice. The sizes most generally employed are No.'s 60 and 70. In Fig. 2 is shown a crucible of the common shape. The lid is rarely used. Some of the mills use special shapes (i. e. taller crucibles) and which are known as "brass specials," but this is a matter of individual need and such shapes are easily obtained from crucible manufacturers.

Crucibles will usually run from 25 to 35 heats, and often a greater amount can be obtained if care is used. When they begin to show cracks at the top and are quite thin, they are usually considered as useless and are thrown away. Old crucibles are now pur-

chased by various people for making stove polish and similar purposes. Before selling, however, they should be hand picked in order to remove any metal in the form of skulls or linings that may be in them. Unless this is done, whoever purchases the crucibles will obtain a good bargain. In Fig. 3 an old crucible is illustrated, showing how it appears when it is about to be thrown away. It may be said that it is not considered a paying investment to grind up crucibles for the metal there is in them, as it involves too much labor for little return. With hand picking, comparatively all the metal can be obtained.

The life of crucibles depends upon the care they receive. Some casters will make a crucible go 40 heats, while others can obtain only 25 heats. The "personal equation" seems to be the factor that enters.

directly over the crucible so that the "pulling-out" hook can be inserted in lifting out of the furnace.

Melting the Brass.

It is a time honored custom of the brass industry that the brass caster should commence his day's work at the beginning of daylight, and his helper, therefore, starts the fires a couple of hours before this time, in order to have the metal ready at the earliest possible moment. This custom still prevails. It has been in existence so long that it is difficult to ascertain the reason for it, but it is believed it started with the desire to have a sufficient amount of metal cast, and ready for rolling when the rolling mill started up at seven o'clock. In former times, a comparatively small stock of metal was carried and cast

Fig. 4. Cabbages of Brass Scrap Indicating Form Suited for Use in Crucibles.

The tongs are an important piece of apparatus. The variety used is shown in Fig. 5. The jaws of the tongs are usually made of Norway iron, with the handles of rather stiff Bessemer steel in order to hold their shape. The tongs are held on the crucible by a ring slipped over the handle. The jaws are recessed

metal could not be stocked as it is now on account of the lack of capital. By starting the casters in early, plenty of metal will be produced. The item of secrecy, which has always prevailed in the casting shop to a certain extent, is not, I believe, responsible for the early morning work, as casters do not finish much

before noon and it would be easy to find out what was going on then.

In melting, scrap must always be considered as a large amount always accumulates. A small amount is placed in the bottom of the crucible to act as a cushion for the copper and prevent injury to the crucible. The brass scrap also aids the melting of the copper and

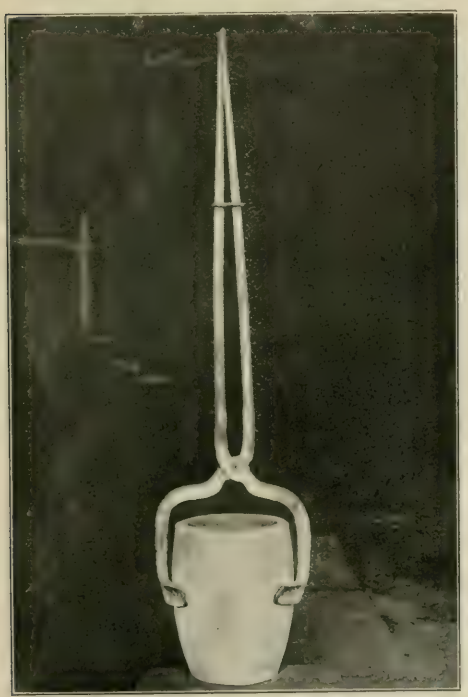


Fig. 5. The Tongs Used in the Casting Shop of Brass Rolling Mills.

the zinc present acts as a deoxidizing agent as soon as the copper begins to melt. It has been found that better brass can be made by placing a small quantity of scrap in the crucible with the copper. The crucible is placed in the fire and coal put around it before the metal is placed in it.

The copper is next put in, and then some charcoal. The lid is then pulled on the furnace and the melting allowed to go on. The melting takes from 1 to 1½ hours. When the copper has all melted, the scrap is put in. The amount of scrap used varies from 25 to 50 per cent. At one time, it was thought that by keeping the amount of scrap as low as possible the brass would be better, but this idea has been exploded. As a matter of fact, were it not for the uncertainty of the scrap mixture, it would be better than the new brass, as it has been proved that brass is improved by two meltings, except that the mixture may vary on account of the loss in spelter. The actual quality of the brass, however, is better for the second melting.

The main bulk of the scrap is usually made in the form of cabbages as shown in Fig. 4. This is done in order to produce a compact form of skeleton scrap, clippings and trimmings that would be difficult to insert in the crucible in the loose shape. When the copper has melted, one or more of these cabbages is put into the pot and when melted, the whole is allowed to become sufficiently hot so that the spelter can be added. As the copper begins to melt, however, and before the scrap has been

Fig. 6. Manner of Pulling Out a Crucible with Block and Fall.

added, about a handful of common salt is thrown on the surface and stirred in. This is the only flux used, and it serves to remove the oxide of copper formed in melting. The surface of the metal is next covered with charcoal and is kept so until poured. The use of almost unlimited quantities of charcoal is one of the features of the brass rolling mill

industry, and is attended with good results. Charcoal supplies a reducing atmosphere free from sulphur.

The brass, as previously mentioned, is allowed to heat sufficiently so that the spelter may be introduced. If the copper is not hot enough when it is introduced, the metal will chill and when again heated up, the spelter, being the lighter metal, will float on the top of the copper and finally oxidize and waste. The best heat for the introduction of the spelter is when it "sings" (as casters call it). By this is meant the noise that the spelter makes during the melting and in combining with the copper. When all the spelter has melted, the metal is stirred with an iron stirrer (an inch iron rod with a knob on the end) to thoroughly mix it. If lead or tin is to be added, they are now introduced and the whole mass stirred again. A thorough mixing is essential in order to insure a homogeneous metal.

It is now necessary to allow the metal to heat up again in order to arrive at the right temperature for pouring. The introduction of the spelter has chilled it. If the brass is poured too cold it will not give a good casting. If poured too hot, the loss of spelter is too

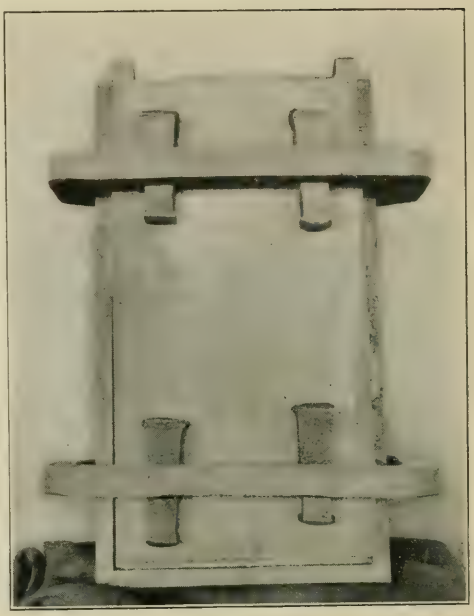


Fig. 8. Mold for Casting Wide Brass (Closed and Banded).

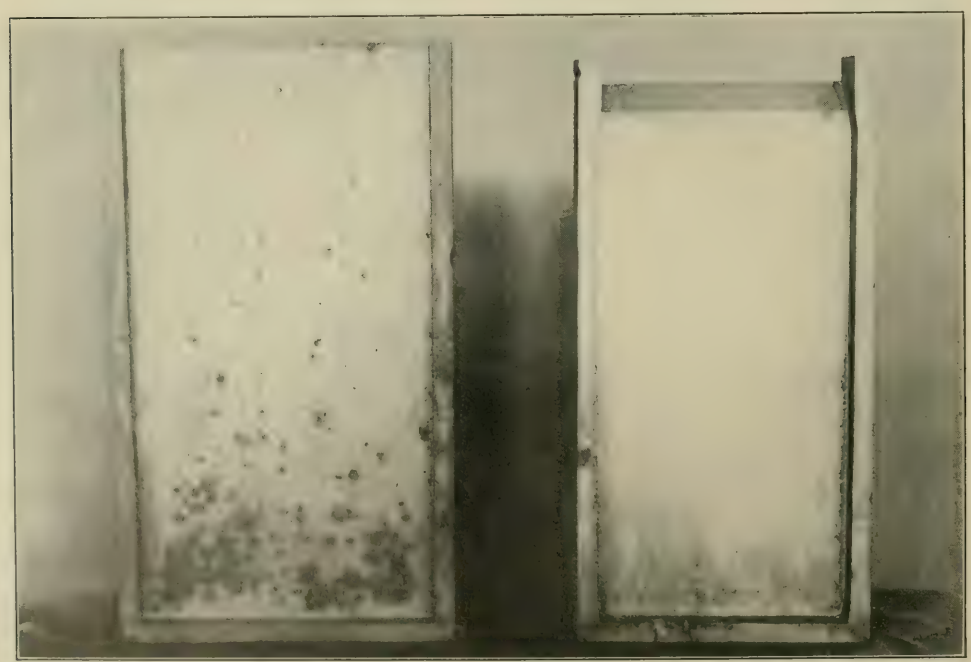


Fig. 7. Mold for Casting Wide Brass, Showing Each Half.

great. From 1 to 1.5 per-cent is the usual loss in the American brass casting shop. Hot metal, however, always gives the best castings and it is better to pour the brass a little too hot than a little too cold. Pyrometers have not yet made much headway in brass melting, but theoretically, they would serve to determine the right pouring temperature and eliminate the factor of uncertainty. As now practiced, the eye is the only indicator of the right heat.

The metal ready for pouring, the caster or his helper pokes the coal away from the crucible with an iron bar and inserts the tongs on the crucible. The hook is inserted and the crucible is then pulled out by the helper by tackle block arrangement shown in Fig. 6. This arrangement is now in almost universal use in brass casting shops and has been in use for the past fifty years or more. It is one that has proved quite satisfactory and attempts to replace with others have not been successful.

The arrangement consists of two tackle blocks with a 3/4 in. rope in them. The top block is fastened to a jib crane and from it a rod and breast-piece extend. This breast-piece and rod are for off-setting the strain exerted in pulling on the rope. The helper places the breast piece across his breast and then pulls on the rope. The caster steadies the tongs with his hands. The rod, attached to the breast piece, also serves to push the crane around to the molds. The rope does not burn as it is too far from the fire and a long hook is used to connect the crucible tongs and the lower tackle block. The advantage of the arrangement is that it provides a much more rapid means of pulling out the crucible than with a chain block, and it also is used for holding and steadying the crucible while it is being poured into the molds.

The Molds.

The molds are made of a soft, gray iron and are not planed. One concern makes practically all the molds for the brass trade, and they are quite satisfactory, both in iron and smoothness. In Fig. 7 is shown a mold for casting wide brass open, while the same mold closed and ready for pouring, is shown in Fig. 8. The mold is held together by means of iron bands and steel wedges. Various modifications of this form of mold are used. Some mills use them with a foot, others use a mold where the joint comes in the middle of the side of the bar, but this kind of mold is the average type used, and the others are made upon the same principle.

Before using, the mold is given a coating of the best quality of lard oil. Whale oil was used at one time and is good, but the smell is objectionable so that now lard oil is almost exclusively used. To make the best casting, the mold should be warm. Very cold molds in winter do not give good results, and the first castings made are not as good as those afterwards produced. The amount of oil on the molds should be enough to give them a good coating, but yet not so much as to run down in the bottom and form a pool.

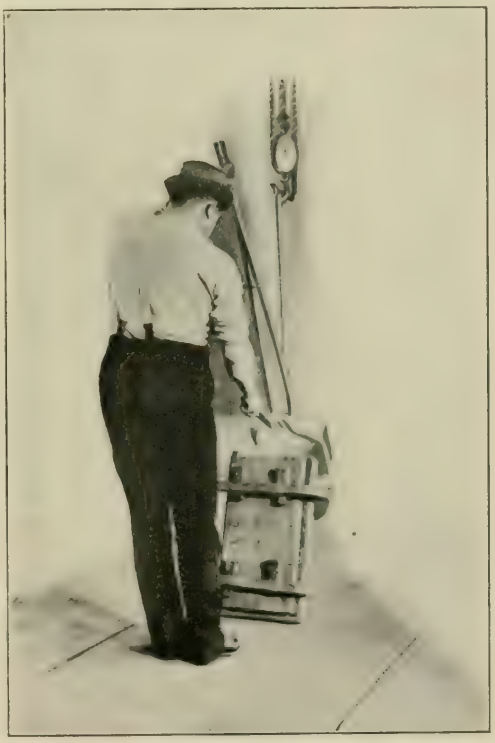


Fig. 9. Method of Casting Brass.

The molds are slightly inclined when poured, and care is taken not to allow the metal to strike continuously in one spot or this will become porous. In pouring, the caster rests the crucible on the side of the mold and holds the tongs in his left hand. With the right hand, the iron skimmer is held at the mouth of the crucible to hold back any dross or charcoal that might run in. The pot is skimmed, of course, before pouring. In cast-

ing wide brass, it is usually necessary to divide the metal into two streams. This is accomplished by holding the skimmer in the pot while the pouring is going on and thus dividing it.

The oil on the mold serves a twofold purpose: First it prevents the metal from acting upon the iron. Second and more important, it burns at the mouth of the mold and thus envelops the stream of molten brass in a reducing atmosphere which will always reduce the oxide provided there are no currents of air to blow the flame away. A stream of molten brass that is not thus enveloped in the oil flame will oxidize on its surface and this oxide will be carried in with the metal causing spills. Some casters appreciate the value of the oil flame to such an extent that they place a piece of cotton waste saturated with oil on the top of the mold and set fire to it before pouring so that the stream of brass will be enveloped from the start. The use of a gas flame has been tried and gives excellent results. The manner of casting may be seen in Fig. 9.

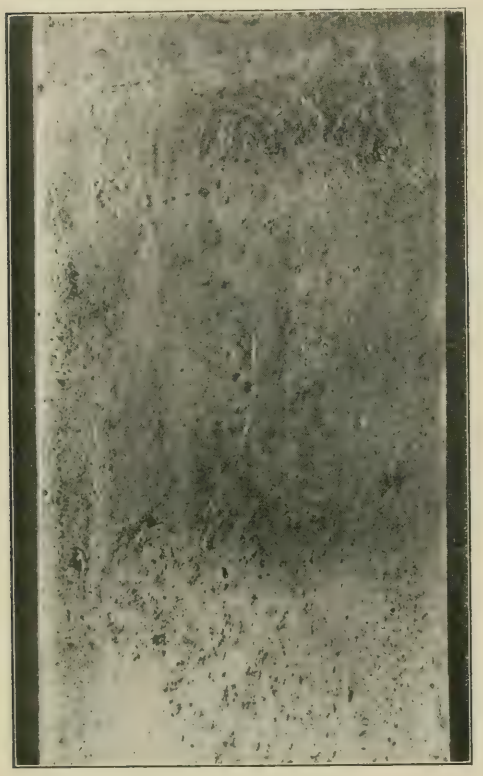


Fig. 10. Appearance of a Cast Bar when Good. The Black Specks are Carbon from the Oil and are Only Superficial.

A caster runs from 8 to 10 fires (10 fires are now more general practice) and when all have been poured, it is called a "heat," "round" or "bout." From 4 to 6 heats per day is the work of the caster, and as a usual rule he is paid by the pound or pot, and all bad metal is charged back to him.

Treating the Skimmings and Ashes.

The fires are allowed to burn out after the last "heat" has been poured, and then the grate bars are pulled out and the ashes dumped into the pit. When they have cooled enough, a workman shovels them up into a wheelbarrow and carts them to the wash-house where they are treated. The large pieces of metal are picked out by hand and the rest is placed in a Hill barrel or Chili-mill and the coal, cinder and ashes ground up and washed away by water. The metal is left in the form of "washings." These are used again in making brass, although on account of their uncer-

Fig. 11. Showing Spot Produced by Allowing the Metal to Strike in One Place Continuously.

tain composition, they cannot be used in any except the cheap mixtures.

The skimmings are usually washed with the ashes, after hand picking, but this is more or less wasteful of metal. There is considerable fine metal in skimmings that is washed away. The use of a skimming tank, in which the brass is skimmed into water, is now becoming more or less extensive and has proved quite economical. The charcoal is saved and may be used over again, and very little metal is lost. It may be said that practically all the metal is thus reclaimed, and without any grinding.

Fig. 12. Spot Produced by Using a Cracked Mold. The Oil Blows from the Crack.

Defective Metal.

The principal defect in the cast brass is what is known as "spills". These are caused by oxide or similar imperfections which cause slivers to form in rolling. Not enveloping the stream of molten brass in the burning oil will cause spills, pouring too cold will also cause them; but the most frequent cause is the oxidation of the copper in melting by not keeping well covered with charcoal during melting. The oxide of copper thus formed is reduced by the zinc with the simultaneous formation of oxide of zinc that becomes entangled in the brass like so much dirt and causes the metal to part in rolling.

A good casting should have a slightly rough surface like that in Fig. 10. The small black spots are specks of carbon formed by the burning of the oil, and are only superficial. The surface should be quite clean by a little scraping. No one has yet succeeded in making a casting that is smooth and perfect, but ones that can be rolled without overhauling are now produced daily in many establishments. They are, however, used for the commoner grades of brass, while those for the best grades must be overhauled by scraping.

As previously mentioned, the metal striking in one spot will produce a porous spot on the casting. Such a spot is shown in Fig. 11. Another difficulty frequently met is from the use of cracked molds. The oil soaks into the crack and when the metal strikes it, a blow is produced with the formation of a hollow, wavy spot like that shown in Fig. 12.

In conclusion, it may be said that the principal difficulty encountered in casting brass for rolling is "spills" and in their elimination scant progress has been made.

Removing Zinc from Galvanized Iron Scrap.

According to a recent French patent, zinc may be removed from galvanized iron by treating in a tumbling barrel of iron with perforated staves, and revolving in an iron tank filled with a boiling solution of zinc chloride, made slightly basic. When no further hydrogen is evolved, the barrel is removed and the scrap washed. Only a small amount of iron is dissolved and this may be precipitated by means of calcium chloride. The zinc goes into solution as zinc chloride which may be used for various purposes. At the end, the solution will be found quite basic, but this is brought back to the necessary or slightly basic condition by addition of hydrochloric acid.

Metal from the last pouring in the form of "buttons" should not be left in a crucible as they frequently crack it by expansion when again melted. Pour the metal out into an ingot mold.

Amount of Waste in Melting Genuine Babbitt-Metal.

The following results obtained in melting genuine babbitt-metal were recently submitted by a manufacturer as indicating that the waste in melting it is more than usually realized. The mixture used was 96 parts of tin, 8 parts of antimony, and 4 parts of copper. New Straits tin, Cooksons antimony and ingot copper were used. The copper was melted in a crucible and poured into the kettle containing the tin and antimony previously melted.

The metal was then stirred in the kettle and poured into the regular ingot molds. The dross was skimmed off from time to time when necessary. The following results were obtained:

Experiment No. 1.

Metal Melted:		
Tin	1402	lbs.
Antimony	116¾	lbs.
Copper	58½	lbs.
Scrap	143½	lbs.
Total	1720¾	lbs.
Metal Obtained	1671	lbs.
Loss	49¾	lbs. = 2.8%

From the operation, 41 lbs. of dross were obtained so that 8¾ lbs. represents the actual loss. This could probably be accounted for in the drops and spatters made in ladling the metal.

Experiment No. 2.

Metal Melted:		
Tin	1440	lbs.
Antimony	122½	lbs.
Copper	60	lbs.
Scrap	83¼	lbs.
Total	1705¾	lbs.
Metal Obtained	1672	lbs.
Loss	33¾	lbs. = 1.9%

It has never been proved that the Ancients tempered copper. Most of the implements that are supposed to have been tempered, are hardened by alloying the copper with tin as any one may now do. Other implements of pure copper have been hardened by hammering (or cold working, as it is now called.) This is also done at the present time.

Refining Platinum in Russia.

At the present time, platinum is receiving more attention than ever before. This is caused partly by the fact that it is now worth practically double that of gold, and partly because its use is rapidly increasing, particularly in the jewelry and electrical trades. No satisfactory substitute has yet been found.

A bill has recently been introduced into the Russian Cabinet Council by the Minister for Commerce and Industry, which proposes to prohibit the exportation of raw platinum and to erect State refineries in Russia. A considerable proportion of the Russian output of platinum is now refined abroad, a large amount being treated by the Norddeutsche Affinerie at Hamburg, Germany. Of the entire production, only about 2 per-cent is refined in Russia. An outside firm now has the monopoly of the business, and has succeeded within quite recent years in increasing the price from 17,000 to 41,000 roubles per pood. It is believed that this continuous and rapid advance will receive a severe check if exportation is prohibited and the refining operation carried out under Russian control.

Ceylon Graphite in Crucible Making.

According to C. A. Davis, U. S. Consul at Colombo, the first exportation of graphite from the Island of Ceylon to the United States was made in 1825, and from that time on our country has been the largest consumer. Recent returns show that the United States continues to be the largest user of Ceylon graphite, and the value of last year's shipments here was $1,806,408 compared with $827,327 for the year 1908. Next to the United States, the largest consumer is Germany, then come Great Britain, Belgium, Hong-Kong and France in succession. While there has been an increase in the quantity exported, there has been no change in price. According to the customs returns, the value of a ton of Ceylon graphite works out at $100.56.

The native merchants have no idea as to the position of the market. They base their calculations on the export figures and draw their own conclusions, without paying the slightest attention to the actual condition of the markets of the world.

A Simple Method of Recovering Silver from Silver Plating Solutions.

The usual methods of recovering silver from cyanide silver plating solutions are quite unsatisfactory. They are as follows:

1. By precipitation of the silver as chloride by decomposing the cyanide solution with muriatic acid. This operation is very unsatisfactory, on account of the great danger from the cyanogen fumes that are evolved when the acid decomposes the cyanide. The operation must be conducted out of doors. Many persons have lost their lives in carrying out this method, and it is one never recommended except in experienced hands, and even then few desire to undertake the precipitation of a large amount. For very small solutions it may answer.

2. By evaporation of the solution to dryness and fusing the residue and obtaining a button of metallic silver. This operation too is somewhat dangerous, as cyanogen fumes are given off during the evaporation. The evaporation is also a difficult operation except in case the necessary apparatus is possessed. Even under favorable conditions, the process is a slow one.

The method about to be described will, it is believed, greatly simplify the recovery of silver from cyanide plating solutions as it is so simple that no special apparatus is required, and is entirely free from danger as the cyanide is *not* decomposed.

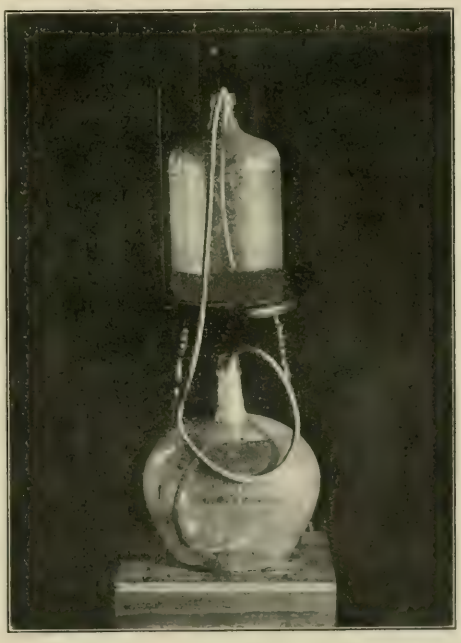
Principle of the Process.

The process is based upon the fact that silver sulphide is only slightly soluble in potassium or sodium cyanide. When a soluble sulphide (such as sodium sulphide) is added to a silver plating solution, the silver is converted into the sulphide which separates out. It will readily be understood, therefore, that nothing could be more simple. No special apparatus, special skill or expensive chemicals are required. The silver sulphide settles readily and the solution may be siphoned off without difficulty.

Apparatus and Chemicals Necessary.

The only apparatus needed are vessels for holding the solution. Tanks, barrels, carboys or bottles may be used so that it may be said that no special appliances are required. Anything that will hold water will do. The operation is conducted *cold.*

The only chemical needed is a sulphide soluble in water and for this purpose *liver of sulphur* has been found to answer admirably. Ammonium sulphide may also be used, but it is more costly than the liver of sulphur and gives no better results. Every plating establishment possesses liver of sulphur or may readily obtain it. It is one of the cheapest materials used in plating.



Method of Siphoning off the Clear Liquid from the Silver Sulphide.

Precipitating the Silver.

The cyanide plating solution should be first diluted with water, as it has been found that the silver sulphide is much more insoluble in dilute potassium cyanide than in strong, and as all plating solutions contain free cyanide, the water is used to reduce the strength. The more water added, the less soluble the silver sulphide will be; but there seems to be no need of going beyond a certain limit. It has been found that if the silver solution is dilu-

ted with twice its volume of water, there is very little loss of silver.

To commence, therefore, take the following:

Water	2 parts
Silver Plating Solution	1 part

Stir the solution well with a stick of wood and then it will be ready for the addition of the liver of sulphur solution.

The liver of sulphur is *not* added to the solution as the solid substance, but is first dissolved in water. Dissolve in the following proportions:

Water	1 gallon
Liver of Sulphur	1 lb.

It is advisable to filter the liver of sulphur solution before using it as it can be more readily seen when all the sulphur is precipitated. A clear, yellow solution is thus obtained. The filtering is not wholly necessary and does not affect the final results, but serves to render it easy to ascertain when the precipitation is complete.

The solutions are all used at the ordinary temperature and need never be warmed. Add the liver of sulphur solution little by little to the mixture of water and silver plating solution and stir. For a few seconds there is no action, but soon the solution begins to turn brown and finally black. Stir well and then add more of the liver of sulphur. In five or ten minutes the black silver sulphide will have settled to the bottom of the vessel and a clear liquid left on top. Take out some of this clear liquid, if necessary to see it in good light, and add some more liver of sulphur solution to it. Allow to stand a few minutes and see if any more silver sulphide comes down. If the solution still remains clear, it indicates that all the silver has been thrown down as the sulphide and no more liver of sulphur need be used. The liver of sulphur, however, must be added to the silver solution until no more silver sulphide is precipitated. This point is readily determined, however, by allowing the solution to settle and then adding more liver of sulphur. An excess of liver of sulphur in the solution does no harm.

Obtaining the Silver Sulphide.

The solution thus treated and containing the silver precipitated as silver sulphide, is well stirred and allowed to stand for a short time to settle. This usually takes an hour or two, but if left over night the silver sulphide will have become more dense than in a shorter time.

The clear solution on the top of the silver sulphide is siphoned off by means of a rubber tube. If the amount of solution is small it may be drawn off in the manner shown in the illustration. The tube is first filled with water and then immersed in the solution.

When the clear solution is drawn down to the silver sulphide, water is added and the whole stirred, allowed to settle and the clear liquid again siphoned off. This should be repeated four or five times. Cold water does as well as hot water for the purpose. After the four or five wash waters have been drawn off, the black silver sulphide is poured on to a filter of some kind (canvas or other fine cloth) or is filtered in a glass funnel with filter paper. Here the washing should be repeated four or five times, allowing all the water to drain off before adding fresh wash water. In this manner the silver sulphide is washed free from any cyanide solution.

The silver sulphide is next placed in a porcelain dish and dilute nitric acid (1 part of water and 1 part of strong nitric acid) is poured on it. One part of the sulphide takes about 10 parts of the acid to dissolve it. The whole is warmed for some time when the silver sulphide will be dissolved as silver nitrate. The solution will usually be grayish-white when the silver sulphide has gone into solution on account of the separated sulphur, but if any black residue remains, it indicates that either the warming has not been sufficiently prolonged or the amount of acid is not sufficient.

When the solution appears free from black sediment, it has warmed long enough and should then be diluted with an equal volume of cold water and either filtered or allowed to settle. The clear solution is one of silver nitrate containing some free nitric acid. The silver may be thrown down with common salt or muriatic acid and silver chloride made of it, or copper wire or sheet may be inserted in the solution and metallic silver precipitated. This part, however, needs no special comment.

Experimental Results.

In order to determine the amount of silver lost in the process that it might be known whether it can be called accurate or approximate, the following experiments were made:

A silver plating solution was made up in a very accurate manner so as to contain prac-

tically the quantity of silver and free cyanide used in ordinary plating.

To make the solution, 24.65 grams of pure silver were converted into chloride and then dissolved in only enough potassium cyanide to take it all up. Potassium cyanide equivalent to 3 oz. per gallon was then added and the whole diluted to exactly 1000 c.c. The solution thus obtained may be considered as an average silver plating solution and contained the following proportions:

Water	1 gallon
Silver	3 oz.
Free Cyanide	3 oz.

This solution is used quite extensively in silver plating flat-ware. It was considered suitable for the test.

The solution was divided accurately into two parts. The first part was diluted with twice its amount of water, the silver precipitated with liver of sulphur, the silver sulphide filtered out and the silver in it determined analytically. The second portion was diluted with four times its volume of water and the silver precipitated and determined in the same manner. The amount of silver obtained is as follows:

Silver Used	12.325 grams
Silver Obtained	12.109 grams
Loss	0.216 grams = 1.75%

Second Solution.

Silver Used	12.325 grams
Silver Obtained	12.136 grams
Loss	0.189 grams = 1.53%

It will be noticed, therefore, that in the solution with the most water added, the loss of silver is the less, but the amount of loss is quite small in either case. It is no more than would be expected in any such operation of recovering silver from a solution.

The ease of working the method, the freedom from any cyanogen gas, and the low cost commend the use of the process and it is believed that it will be found all that is claimed for it.

Japanese lacquer is not really a lacquer but is, in reality, a varnish. It is analagous to the spirit varnishes containing shellac.

The Power Required in the Plating Department of a Manufacturing Plant.

In a recent investigation regarding the feasibility of replacing several independent power plants with one central plant in a large manufacturing concern, the engineers, Lockwood, Greene & Co., of Boston, had occasion to determine accurately the power requirements of the various departments. As their tests were carried to a great decree of refinement, some very interesting data was collected concerning the amount of power required for certain individual machines and groups of machines.

The information they obtained in regard to the power necessary to drive the equipment in the plating department is of particular interest as there is a great scarcity of such data. In the hardware plating department, the equipment included one 60" Sturtevant exhauster, one 1500 ampere plating dynamo, two plating rolling barrels and four small brush lathes. Tests showed that the plating barrels and lathes could be started with 8.1 h. p. ; the exhauster, the four lathes and the dynamo, running free, required 6 h. p. ; the two plating barrels required 6.7 h. p. ; operating all the equipment and supplying 600 amperes at six volts to the barrels required 14.6 h. p.

In the fork and handle finishing department it was found that 100 polishing and grinding wheels required about 1/2 h. p. each. In the cutlery plating department tests showed that the average power consumption of the nickel tanks was 0.65 h. p. each, of the silver tanks 0.68 h. p. Each end of the stripper tanks 0.70 h. p. each. For this class of work a general allowance was made of 0.70 h. p. per tank.

Pin-dust is the name applied to the fine, granular yellow brass material resulting from the manufacture of brass pins. It is always soaked to a greater or less degree with oil.

While a benzine dip is quite efficacious and satisfactory in removing the greater portion of grease or oil from work to be plated, it always involves more or less danger and the majority of establishments do not care to use it. Various soaps are now used in place of it as they have grease dissolving properties.

Erroneous Idea in Regard to Removal of Iron from Molten Brass by Means of a Magnet.

There seems to be a prevailing notion in the brass foundry industry that if a powerful electromagnet be held over a pot of molten brass containing iron, the magnet will remove the iron, leaving the brass entirely free from it; and that such a method would be useful in making a yellow brass ingot from light brass (which is the term for ordinary brass scrap such as old clocks, lamps, etc., and which contain considerable iron in the form of screws, rivets, studs, etc.)

This method, were it possible, would prove a most valuable process to the scrap metal refiner; but, unfortunately, it will not. Although iron is magnetic when cold and at a very low red heat, (below the melting point of brass), it loses its magnetic property when at the temperature of molten brass.

As an illustration of the non-magnetic property of iron at a red heat, let a piece of iron, such as a nail, be heated to a red heat and a small magnet applied to it. The magnet will not attract it. As the iron cools, keep trying the magnet upon it, or hold it near the iron while cooling. When nearly a black heat has been reached, the iron will immediately jump for the magnet and cling to it.

It will be appreciated, therefore, that, inasmuch as iron or steel is not attracted by the magnet at a red heat, it cannot be removed from molten brass in this manner.

Gun Metal and Its Present Value in the Brass Foundry.

Gun-metal owes its name to the fact that at one time it was used by our own Government for making bronze cannon. The advent of the forced steel gun, however, soon brought about the abandonment of the bronze gun, but the name of gun-metal has still remained, and while not used at all at the present time for making guns, it has proved to be the best of the so-called tin bronzes for many lines of work.

Among the ordinary mixtures of the brass foundry, there is none so good as a straight gun metal. It owes its value to several characteristics:

1. It casts exceptionally well, with soundness and with a small amount of shrinkage.

2. It is stiff and strong, and while not possessing the high tensile strength of some of the other bronzes, it is a very reliable mixture and much dependence can be placed upon it.

3. It is quite non-corrosive and stands sea water well.

Two general formulas are in use for gun-metal:

For Work Requiring the Highest Strength.

Copper	88 lbs.
Tin	10 lbs.
Zinc	2 lbs.

No lead is used in the above mixture as it has been found to detract from its strength. The metal is hard and tough and these properties must be taken into consideration when it is used. It cannot be worked on high speed machinery. It will give about 30,000 lbs. per sq. in. tensile strength in good castings.

The second formula is frequently used, though not as much as the other. It differs from the first mixture only in the lead which it contains. The lead is added for the purpose of imparting a free cutting quality. The mixture is not as strong as the one without lead.

Free Turning Gun-Metal.

Copper	86 lbs.
Tin	10 lbs.
Zinc	2 lbs.
Lead	2 lbs.

This mixture is hard, but turns more freely than the first one. It is practically as non-corrosive as the first.

When the best bronze castings are desired and there is no stint in cost, the use of the first mixture is always advocated. It will cast well and there will be little waste in melting. Customers will usually be satisfied with it for the majority of work when a strong bronze is desired. It should always be made from new metals.

The use of gun-metal in a brass foundry is always attended with great satisfaction, both to the molders and owner. It is to be recommended for the general run of work and the castings will be found exceptionally uniform. Uniformity in a general run of work is always advantageous, and in gun-metal castings it will be found in the highest degree. In fact, there is no other mixture that will give such satisfactory results.

A New Black Finish on Brass, Bronze and Copper by Means of Potassium Persulphate.

The persulphates are comparatively new chemicals and it is only within the past five or ten years that they have been in commercial use. Among them, potassium persulphate is the best known and can now be obtained commercially at a fairly reasonable price (about $1.50 per lb.). The persulphates have the property of giving up oxygen when heated in solution, and it is to this property that the present method of producing a black color on brass, bronze or copper owes its existence. The oxygen given off, oxidizes the surface of the metal with the production of the black color.

The process was discovered and first described in the *Deutsche Mechanische-Zeitung* by E. Grosschuff. The method has also been proved to be satisfactory and capable of giving a black color equal to that of the best black nickel. The author describes his process in the following manner:

"Copper and alloys rich in copper are not colored black by alkali solutions alone, but only in presence of an oxidizing agent. The heating of the metal in a 5 per-cent solution of caustic soda is recommended, to which frequent additions of about 1 per-cent of potassium persulphate are made. The solution is maintained at the boiling point. Zinc, tin, aluminum, iron, nickel, German-silver and hard and soft solders are not colored by this treatment. For brass and aluminum-bronze, a 10 per-cent solution of caustic soda must be used. A film of cuprous oxide is colored black more readily and rapidly than metallic copper. Spots of solder or of passive copper on the surface of the metal are preferably coated with copper by electrodeposition before the treatment."

The method was subjected to test and found to be as stated. The manner of carrying out the process is as follows:

Solution for Copper or Bronze.

Water	1 gallon
Caustic Soda	4 oz.
Potassium Persulphate	1 oz.

The solution is heated to boiling and the copper or bronze article, previously cleaned from grease or oil, is immersed in it. The heating is continued for a time sufficient to produce the black color. This may take from 5 to 15 minutes as the color gradually forms and starts with a brownish discoloration which gradually deepens, finally becoming black. If the color is too slow in forming, then more of the potassium persulphate should be added.

Solution for Brass.

Water	1 gallon
Caustic Soda	8 oz.
Potassium Persulphate	1 oz.

The method of treating the brass is the same as that of the copper. The color is equally as good, however, but the larger amount of caustic soda is required to attack the surface.

Brass Article Blackened by the Solution.

The black color produced is very adherent and may be buffed to a high color. If, however, the surface of the metal is highly polished, the black color film will likewise be polished.

The process seems highly satisfactory, but cannot be called a cheap one, on account of the fact that the potassium persulphate is not cheap. For many purposes perhaps it will be

found useful, and is one of the things that serves to bring about progress in the art of metal coloring.

The Amount of Copper that Can Combine with Metallic Lead.*

As the question has often been asked how much copper can be combined with metallic lead in the regular way, and many lead alloys are sold in which it is stated that considerable copper is present, it was found expedient to make an experiment to settle the question. It is well known, however, that lead will combine with but a small amount. Just what this amount is does not appear to have been determined before.

To make the experiment, the following amounts of lead and copper were melted together in a graphite crucible:

Lead	95 lbs.
Copper	5 lbs.

The two were placed together in the crucible and heated to the melting point of the copper. The mixture was then stirred and poured out into an ingot mold and allowed to cool. The ingots thus obtained were then melted in an iron kettle at about the temperature used in melting lead. When this was done and the metal poured, a thick, pasty mass, resembling zinc dross was left. Raising the temperature a little higher gave the same result, and it was found that practically a red heat was necessary in order to render the whole mass fluid.

The whole metal was then re-melted at about the pouring temperature of molten lead, and poured out into molds. Only the liquid portion was poured. The thick, pasty mass which was left was not used. The liquid portion ran freely into the mold, and as far as could be seen, ran as well as pure lead.

It was assumed, therefore, that the liquid portion which was poured into the molds, contained the maximum amount of copper that lead will take up and run freely at the pouring temperature of molten lead. An analysis gave the following results:—

Lead	99.36 %
Copper	0.64 %

It should be appreciated, however, that when tin is present in a lead alloy, more copper can be combined with it than when only lead is present. The more tin used in a lead alloy, the greater the amount of the copper than can be combined.

It will be understood, accordingly, that less than one per-cent of copper will alloy with lead under ordinary conditions.

*Laboratory Experiment.

Fluxes and Fluxes.

More good news for the foundryman! The flux barometer is constantly rising. Flux first and metal afterwards may soon be the rule. Martha P. Jewett of Evansville, Indiana, has been kindly granted a patent (No. 977,406, Nov. 29th.) on five brand new fluxes:

Formula No. 1.

Fluor-Spar	55 %
Red Clay	35 %
Dolomite	10 %

Colored with carbon or left uncolored.

Formula No. 2.

Fluor-Spar	50 %
Clay	36.4 %*

Colored with carbon or left uncolored.

Formula No. 3.

Fluor-Spar	80 %
Red Clay	10 %
Zinc Carbonate	5 %
Dolomite	5 %

Also 1 lb. of black oxide of manganese to every 500 lbs. Colored with carbon or left uncolored.

Formula No. 4.

Fluor-Spar	30 %
Red Clay	10 %
Zinc Carbonate	10 %

Black oxide of manganese, 8 to 9 lbs. per barrel. Colored with carbon or uncolored.

Formula No. 5

Fluor-Spar	33-1/3 %
Red Clay	33-1/3 %
Dolomite	33-1/3 %

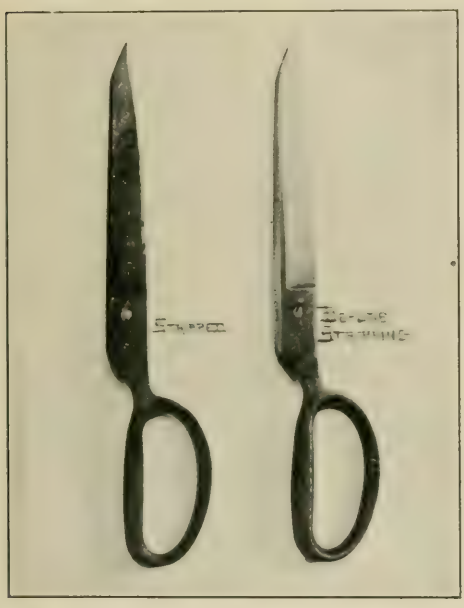
Black oxide of manganese, 2 lbs. to every 57 lbs. of the mixture.

According to a recent Consular Report, there is only one company in Italy making aluminum. The works are located at Bussi di Tirino, Province of Aquila. About 4,000 horse-power are utilized and 210 men are employed. The output is about 600 tons per year.

*What the remainder of the 100% is not disclosed.

Stripping Nickel Deposits from Iron or Steel.

Upon many kinds of nickel plated iron or steel work it will hardly pay to strip the nickel off in case a poor job of plating has been done, as the goods may be too cheap to warrant it. In such cases it is wise to consign them to the scrap heap. In other instances it may be frequently desired to strip the nickel from expensive goods, such as cutlery, firearms, surgical instruments, or similar kinds of articles upon which considerable labor has been spent previous to nickel plating.



Steel Shears Before and After Stripping of the Nickel.

The method of removing the nickel usually has been to re-polish the goods, but in many instances this has been too expensive. While nitric acid will remove the nickel, it also attacks the iron or steel and pits it. The following stripping bath has been in use for many years in some concerns who have kept it to themselves. It is not generally known. The solution is used with the electric current:

Nickel Stripping Solution.

Water	1 gallon
Potassium Cyanide	12 oz.
Yellow Prussiate of Potassium	2 oz.

The iron or steel to be stripped is hung in the solution as the anode and the nickel "backed off." The bath is used warm. The temperature of about 120°F. is generally employed. A steel or iron plate is used as the cathode.

For goods upon which there is only a light nickel deposit the stripping takes but a few hours. Heavy nickel deposits may take all day. The operation, however, requires no attention and the time consumed is not of much importance.

The iron or steel surface is not attacked and will not be pitted. The nickel is frequently lifted off in scales or layers. The usual current for nickel plating is employed.

Purifying Magnesium.

The largest producer of metallic magnesium in the world is the Chemische Fabrik Griesheim-Electron of Frankfort, Germany. They use the following method for purifying magnesium:

The metallic magnesium is fused under a layer of common salt which has a melting point considerably higher than that of the metal. The whole mass having been thoroughly stirred is allowed to cool. The salt solidifies first leaving the molten magnesium underneath. The crust of salt is then broken and the magnesium poured out into a closed vessel heated to about 700°C. The metal is then maintained at this temperature for some time while a current of hydrogen gas is passed through it. This gas has no effect on metallic magnesium itself, but serves to remove the traces of chloride that may be still present in it.

By removing the last traces of chlorides, it is claimed that the magnesium is rendered much more non-corrosive. The corrosion of the metal, it is stated, is caused to a great extent by the presence of impurities.

It has been found that the reason some varieties of soft steel or iron rust or corrode so rapidly, is on account of the impurities in it. The purest iron rusts the slowest. A very pure iron is now being made for use in instances where the minimum amount of rusting is necesary, and it has been found to give excellent results. It is almost free from impurities.

A Review of the Nickel Plating Industry.*

By Charles H. Buchanan.

The nickel plating industry in this country was developed and carried on practically in the early 70's in New York City by a few job plating concerns. The nickel was obtained from Joseph Wharton, who controlled mines in Pennsylvania, and was used for anodes in the form of grain nickel. Dr. Isaac Adams of Boston, Mass., was the inventor of the process of the electrodeposition of nickel, using sulphate of nickel and ammonia (double nickel salts) for his solutions. About that time two or three plating concerns were using chloride of nickel and ammonia solutions with good results and continued to do so until Dr. Adams' patents were sustained some time later.

My first experience in nickel plating dates back to the early days of the process. For nickel anodes, we used large carbon plates set in hard wood frames, holes being drilled in same in order to attach the canvas covers and make a good receptacle for holding the grain nickel. The carbon anodes were then filled with coarse grain nickel, packing it in tightly to form a good contact with the carbon plates. In depositing from this form of an anode, the grain nickel would oxidize freely, making it necessary to wash them out frequently in order to remove the loose oxide and form better conductivity. The old nickel that was removed from the carbon anode which had been run for some time in the bath, was saved and dissolved with acid for nickel salts. In fact, at that time the platers made their own nickel salts, and with the assistance of a helper ran a number of batteries in order to obtain enough current for the tanks.

The Bunsen cells proved to be the best battery at that time for nickel plating. In order to gain time in plating, we would run a couple of cells on a tank full of iron work during the night. With the low tension current and time, we obtained a fine, heavy deposit.

I have noticed that some plating plants are now using a carbon back basket and other receptables to use up their scrap nickel in their plating tanks. I fail to see where there is any economy in this method. The oxide that forms on the pieces of anodes, also the sediment and impurity with poor circulation, make a partial non-conductor of the anodes. This form of using up scrap anodes has been tried out several years but with little success. It is more profitable to sell the scrap or have same recast.

The first experience we had with cast nickel anodes was not very satisfactory. In a short time they began to disintegrate and crumble, making it necessary to cover them with a muslin bag in order to hold them together. About the time the plating dynamo was being perfected in 1875 and 1876 we were able to obtain anodes that were more satisfactory. The plating dynamos were invented and perfected by some of the nickel platers in the early days of plating; Mr. Edward Weston, inventing and perfecting the Little Wonder dynamo for the Hanson & Van Winkle Co.; Mr. L. L. Smith, an old plater, inventing the Little Joker dynamo for Wallace & Sons, of Ansonia, Conn. And, I believe, Mr. Brush, of Cleveland, was interested in plating and it was due to one of his first plating dynamos that he discovered the use of the carbon light. This was certainly a good record for some of our older platers.

Nickel anodes are cast generally in two grades for the electro-plating trade, 90-92% and 85-87% in purity of nickel. The standard grade is 90-92%, although a good many concerns prefer the 85-87% anodes. The lower grade of anode dissolves more freely in the bath; the oxide forming more readily on the surface of the anode, they have to be cleaned frequently They are a popular anode with some of the stove foundries, also concerns doing considerable steel or iron work. The nickel deposit has a good white color. In nickel solutions that have been run some time in connection with the lower grade anodes which contain iron, some of the iron is deposited with the nickel. In fact, all nickel solutions contain more or less iron, part of which is precipitated as hydroxide and a small percentage going over and being deposited with the nickel.

My experience has been when depositing from the lower grade anodes it is better not to use too high a voltage and a solution that is about neutral. This anode is termed by some of the platers a soft anode on account of its free solubility to the bath. When it is alloyed and cast properly it makes a good anode for

*Reprinted from The Quarterly Review of the National Electro-Platers' Association.

some classes of work. When nickel solutions become polluted with impurities and contain much iron and sediment, at the low price of nickel salts I think it is better to throw away the old solutions and make new, especially where considerable iron work is being plated.

The quality of a good nickel anode depends upon the right percentage of nickel in purity, to be free from copper and zinc or other metals that would cause the deposit to be dark or streaked; a solid and dense anode with a fine grain forming a good conductor, furnishing metal to the solution rapidly to replenish the bath as the nickel is being deposited at the cathode, wearing down well on the surface in order to remove the oxide from the anode freely. An anode should not disintegrate. That is, the nickel should not separate out in metallic particles instead of forming the oxide.

A spongy or porous anode does not work well. I have noticed anodes of this character to be fairly well insulated from the solution as nickel salts, extending in the cracks and porous part of the anode, forming a partial non-conducting terminal. Anodes that do not dissolve freely in the bath are expensive to use, requiring more nickel salts to replenish the bath with metal.

A good nickel anode with the solution at the right density should dissolve freely enough, or nearly so, to supply the bath with metal as fast as it is deposited at the cathode. The specific gravity of a nickel solution should not be too high. A density of 6° Beaumé would be a good standard solution for the majority of work plated in still baths. For basket work and small pieces done in bulk that are to be tumbled or water rolled, a density of 5° Beaumé gives good results. This will give the anodes a chance to work freely in the bath. Anodes that are run in a solution of high specific gravity, have a tendency to disintegrate and do not wear down evenly. This does not apply to agitated nickel solutions where the specific gravity is greater and more current density is used.

An anode that is porous has a tendency to form oxide in the interior portion of the anode, dissolving readily at that point and forming a partial non-conductor of the plate.

In taking care of nickel anodes, the first important feature is to have good, heavy conducting hooks, whether they are copper or nickel, having a good contact surface on the anode rods. The nickel hook is preferred by a good many platers, as it does not corrode easily and gives a better alignment to the anodes, making a good, clean connection without impurities getting to the bath as from the copper or brass hooks.

After the anodes have been in the bath and worked until the first oxide has formed well, they should be removed from the bath and cleaned off in water with a stiff brush just enough to remove the loose oxide. This will remove any skin or scale that might have formed on the anode in casting, also giving the plate a chance to dissolve evenly. The oxide is saved and an allowance for same is made by the anode manufacturer.

I have noticed anodes from which about all of the nickel had been deposited, the scale or skin remaining on the surface covering the oxide which was about as thick as the original plate. If the anodes had been cleaned to remove the scale when the first oxide was formed better results would have been obtained, also a saving in nickel salts. An anode that has been sand blasted will remedy this trouble. Cleaning the oxide from a nickel anode gives more metallic surface to be dissolved readily by the current, better conductivity, wearing down more evenly and keeping off more or less of the mud and impurities that form on the anode from the bath.

It is not necessary to scrape an anode down to a hard metallic surface to clean it. Just remove the loose oxide with a stiff brush; this leaves the plate in a better condition to dissolve in the bath.

Some platers have stated that nickel anodes contain too much carbon, which forms on the anode in the process of plating. This is not the case, as the analysis shows less than 1% in carbon and this is not detrimental to the anode. The black oxide of nickel, iron oxide, with the carbon and impurities form on the anodes. Carbon renders the nickel more fusible in casting. The presence of iron in a nickel anode makes it more homogeneous and soluble, also wearing down evenly, as in former years more carbon was used in order to cast the metal at a lower temperature.

In certain classes of work where the surface of the articles is exposed more to the upper portion of the anode, a heavy deposit being required on the articles and the upper strata of solution being lighter in density, the anodes will dissolve quicker at this point, cut in and break off, making quite a loss in broken anodes. This also occurs in mechanical or barrel plating with the curved anodes. It is

overcome by casting plates with a reinforced and heavy top. Anodes in this form wear down well without much loss.

A great many anodes are sold for the mechanical plating machines or barrel plating, and the trade in this line is increasing. Most every manufacturer that does small work in bulk has installed the mechanical plater. In referring to this class of plating, it would assist the plater very much by having an ammeter connected in line in addition to the usual voltmeter. In nickel plating work in large quantities in barrels, the solutions rapidly become full of sediment and sometimes partly metallic, causing more or less short circuiting. The solutions are worked at a much higher density than in still plating, and the voltage is increased on account of the resistance of the barrels. In this class of plating the anodes have a severe test.

The consumer, in buying anodes, would do well to look to the lasting qualities and durability of a nickel anode. The percentage of nickel may be all right, but that is not all that constitutes to make up a good anode. I have noticed anodes that would disintegrate badly and in a short time were used up with considerable loss in the metallic nickel, separating out from the plate.

In preparing nickel for an anode by running it over two or three times with the proper fluxing and temperature, the metal is purified making a solid, dense and homogeneous casting. By this method, the durability and lasting quality of a nickel anode is obtained. Is it not more profitable to purchase anodes for durability and quality, than to buy them principally for the percentage of nickel that they contain?

In closing this article on nickel anodes, I wish to state that this branch of the plating industry in this country has greatly increased. In the early 70's, I recollect there were only five nickel plating plants; three in New York City, one in Brooklyn and, I believe, one in Boston. All of these were job plating plants. To-day, almost every manufacturer of metal goods has installed a plating plant. About 1,000,000 lbs. of nickel are cast in anode form yearly by the anode manufacturers.

Negotiations are now being carried on to amalgamate all the foreign interests producing aluminum, into a syndicate so that prices can be controlled to a better advantage.

Secret of Casting Siamese Bronze ("Samrit-Bronze.")

The following description of casting bronze in Siam is given by Carl C. Hansen of Bangkok, Siam, U. S. Vice-Consul-General in that city:

"According to old records, the art of bronze casting was introduced into Siam by the Chinese in the eleventh century. However, bronze has been known throughout Indo-China since earliest times, as shown by the finds of bronze hatchets and arrowheads in limestone caves and other places of deposit of prehistoric remains. Ancient bronze figures of Indian divinities and of the Buddha testify to the early employment of the bronze founders in these cults in Siam.

Figures of the Buddha are found in the north of Siam in great numbers on the sites of ancient temples which have been crumbling for centuries, leaving the majestic bronze figures standing inclosed by great forest trees, and for worshippers only the wild beasts of the jungle. The interesting point about these figures is the perfect condition of the bronze after centuries of exposure to a tropical sun and rains.

Discovery of the Old Formula.

This bronze is called by the natives "samrit" —the perfect or auspicious alloy—and its composition for a long time remained a mystery, until a few years ago the formula was discovered by Major Gerini in an old Siamese manuscript belonging to the late king, of which the following is a translation, with remarks by the Major:

"Take 12 ticals (1 tical equal to one-half ounce avoirdupois) weight of pure tin, melt it at a slow fire, avoiding bringing it to red heat. Pour 2 ticals' weight of quicksilver stir until the latter has become thoroughly absorbed and amalgamated; then cast the mixture in a mold, forming it into a bar. Take one catty in weight (80 ticals) of refined copper and melt it. Then gradually incorporate with it the amalgam, keeping in the meantime the fused mass well stirred.

When this has been done, throw into the crucible a sufficient quantity of ashes obtained from the stems of the bua-bok (terrestrial lotus) creeper, so as to cover the molten metal. Remove the dross with an iron ladle: the metal remaining is samrit bronze. According to this recipe the proportion of the in-

gredients employed in the manufacture of the alloy in question thus proves to be: 85.11 copper, 12.76 tin, and 2.13 quicksilver. A late qualitative analysis shows that this alloy also contains traces of gold, silver, and iron.

One of the best known statues of the Buddha cast of samrit bronze may be seen in the city of Pitsanuloke, Siam. This figure dates from the beginning of the eleventh century, and ranks among the most beautiful objects of art that the Siamese have ever produced.

Mystic Qualities—Present Casting Method.

Samrit bronze was also much used in old days for casting vessels and implements for sacred uses, and was supposed to be endowed with mystic qualities.

The art of casting bronze Buddhas still forms quite a home industry in Siam. The method followed is to mold a figure in clay and coat it with wax, and then apply a coating of clay; the wax is melted by the application of heat and the molten metal poured in; when cold, the mold is broken and the figure cleaned and polished. In the temples of Bangkok may be seen many fine specimens of modern statues of the Buddha, which compare favorably with similar art of other countries."

The Production of Titanium Alloys.

In two patents recently issued to A. J. Rossi of the Titanium Alloy Co. of Niagara Falls, N. Y., (U. S. Patents 979,393 and 979,394, Dec. 20, 1910), the method of making alloys of zinc and titanium, and tin and titanium are claimed. The oxide of titanium and oxide of zinc are placed in a crucible with metallic aluminum and some slag, and heated in a furnace. The aluminum reduced the oxides to metal with the result that an alloy of zinc and titanium is formed. By the use of oxide of tin in place of oxide of zinc, an alloy of tin and titanium is produced.

The alloys are for use in making brass and bronze castings. It is stated that when titanium is introduced into brass or bronze, pinholes and other unsoundness are eliminated.

The addition of rosin in a small amount to a caustic potash solution will hasten its action upon oil or grease, particularly in the removal of mineral oils.

Tricks in the Scrap Metal Trade.

(First Paper.)

Sanding Yellow Brass Chips.

The scrap metal industry has always been an attractive field for unscrupulous and dishonest individuals who have sought to deceive their customers by various unique and ingenious means. This fact has always been deplored for the reason that the honest and conscientious members of the industry have had to suffer for the sins of their *comperes.* Such a condition has placed the whole business in the wrong light and it has frequently resulted unfavorably for all concerned. It may be said, however, that there seems to be a wave of change in opinion passing over the metal trades and it is quite favorable to the honest dealer. The scrap metal industry is a large one and is constantly increasing so that it is a matter of much satisfaction to find that the honest scrap metal dealer is beginning to come into favor at all. Manufacturers have found that prices way above the market cannot be paid for scrap materials without some reason. The reason has been found many times, much to the dissatisfaction and financial loss of persons who have been attracted by the excellent prices offered. In many instances it has been found that the honest dealer pays the *real* market price, and when business is done with him the transaction is one of a business-like nature, not accompanied by dishonest tactics to deceive when possible.

On the other side, brass founders are also finding it profitable to transact business with honest scrap metal dealers. They are not subject to the annoyances and deception that are practiced by other members of the industry. If composition chips or scrap is purchased, it will usually be found that it is this material and not filled with manganese-bronze. If not, however, the error will be rectified.

In order to indicate some of the dishonest practices prevalent in the scrap metal business to the detriment of the honest dealer, it is proposed to enumerate some of the tricks carried on.

An old and profitable trick for the dishonest scrap metal dealer is the so-called method of

"Sanding Yellow Brass Chips." It consists in mixing a certain amount (as much as the chips will stand) with yellow sand. In this way the scrap metal man obtains brass prices for sand.

As sand, if mixed with the chips direct, would be noticeable the following method is carried out to overcome it: Scrap bronze powder is easily obtained in the scrap metal market and is the sweepings, etc., produced in the manufacture of bronze powder. It is very fine and slightly greasy. It readily adheres to anything, except wet material. The sand is dried and then mixed with a small quantity of the bronze powder. This coats them over. The bronze powder is practically the same color as the brass. In reality, it is made from yellow brass and is not bronze at all although so called. It is also cheaper than the brass chips.

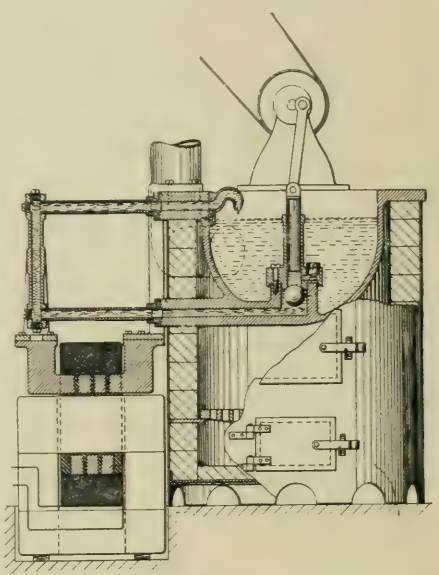
The sand, when covered with the bronze powder, is mixed with the chips and is then entirely concealed. The usual amount of sand to mix with the chips is about 10 per cent, and when added to them it is very difficult to see it. Those who purchase the chips, therefore, obtain the sand at the price of the chips. To look at a pile of chips of this kind, one would say that they were of good quality.

The method of ascertaining this deception is to take some of the chips and examine them. As yellow brass chips are usually fine, the sand is not readily seen, although the particles may be detected if they are spread out on a paper. The usual method, however, and one that is absolutely certain, is to take a small quantity of the chips, soak out the oil and grease in benzine or gasoline so that acid will act upon them, and then dissolve (in a porcelain dish) in dilute nitric acid. One part of the strong acid and one part of water are used. The chips will dissolve and leave the sand.

Many brass foundries are accustomed to use yellow brass chips and if purchased from dealers the presence of sand should be looked into. It is so easy to introduce the sand, and as it will have no bad effect on the metal made from them, there is always a temptation, when the dealer is dishonest, to mix it with the brass chips. The loss to the brass founder, of course, is a financial one as he pays for the sand at the price of the chips.

An Apparatus for Coating Iron or Steel with Lead.

An apparatus for coating iron or steel wire or sheet with lead has recently been patented by George A. Goodson of Minneapolis, Minn. (U. S. Patent 978,448, Dec. 13, 1910). The feature of the patent is in the production of an "allotropic" modification of the lead so that it will coat the iron or steel. The manner of accomplishing it, according to the inventor, is by the use of an electrical transformer.



Goodson's Apparatus for Treating the Lead Previous to Coating.

The lead to be melted is placed in the melting pot (an alloy of lead and antimony is also used) and melted. The pump is then started and the lead is forced out of the bottom tube and into the top of the kettle again, so that a circulation is constantly carried on. The lead passes over the transformer through which an electric current is passed so that a secondary current, the inventor states, of at least 1300 amperes per 3/8 of an inch cross-section is set up.

In this manner, it is claimed, the allotropic modification of the lead is produced so that it will adhere to iron or steel. It is also claimed that an alloy of lead and zinc can be produced by it for use as a plating metal of superior non-corrosive properties.

Solutions for Plating Barrel Work.

Now that mechanical plating apparatus is becoming so extensively used, a little comment upon the solutions used in them may be opportune. It has frequently been found that the reason the apparatus failed to give satisfactory results was on account of the solution and not the apparatus itself.

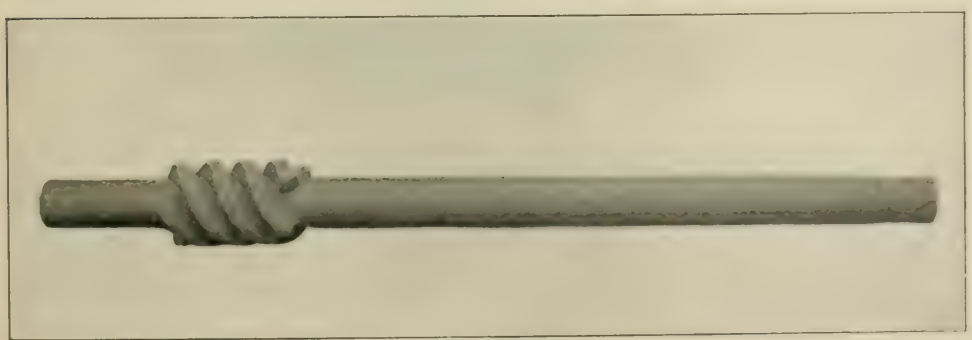
In the use of plating barrels, it should be borne in mind that there is one thing which must be constantly taken into consideration, and that is the increased resistance to the passage of the electric current. If this one point is always considered, then little difficulty will be experienced. The cause of this increased electrical resistance is the interposing of the barrel itself between the anodes and the work that is being plated. The barrel, of course, is a non-conductor and the result is like placing an insulator between the anode and the cathode. The barrel, however, is made as open as possible by various means, depending upon the manner in which it is made, but no matter how open it may be, the fact remains that it cannot be made so that articles can be plated with the facility of rack or basket work. The matter is similar to the plating of work in baskets and upon racks. Every one knows that basket work, when the basket is full, requires more current than rack work, or a stronger solution (the equivalent when the voltage of the current remains the same).

The remedy for increased resistance in the plating barrel method of plating, is to use strong solutions so that the resistance of the solution will be as low as possible, have plenty of anode surface, and not to fill the barrel too full. In addition, the use of a higher voltage current is frequently necessary and it is now common practice, among concerns having number of barrels, to use a dynamo producing a current of from 8 to 12 volts so that the passage of it through the solution may be certain. In some cases, the use of this comparatively high voltage is unnecessary and the usual 6 volt current may be employed, and it may then be cut down by a rheostat.

The use of conducting salts in the plating solutions is quite beneficial. It greatly assists the passage of the current. In the case of nickel solutions, sal-ammoniac is recommended as it has been found superior to common-salt. The cleaning of the anodes in the tank is also necessary, and great care must be taken to see that all connections are bright. When these points are carefully looked after, the plating of goods in a barrel will not be any more difficult than in a basket or upon racks.

A Large Casting of Chromium Bronze.

We are indebted to the Naulty Smelting & Refining Co., 2616 Martha St., Philadelphia, Pa., for the accompanying photograph of a large casting of chromium-bronze recently cast by them. This casting weighed 1200 lbs. and was 10 feet long, and 9 inches in diameter. The casting was made for the Pond Machine Tool Co., of Plainfield, N. J., and to replace a steel worm that proved troublesome.

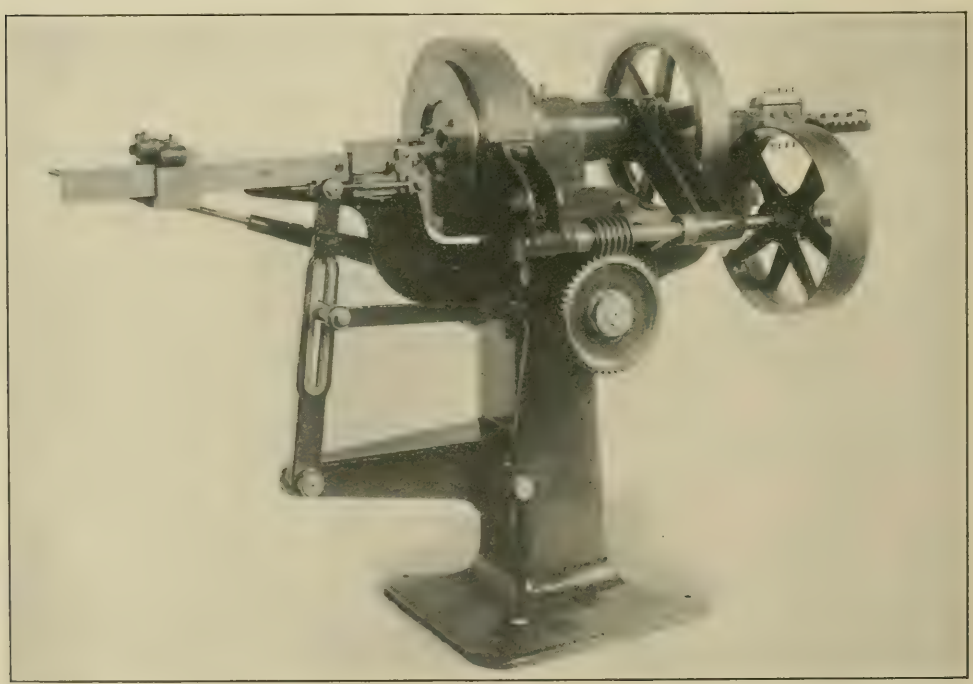


Casting of Chromium Bronze, 10 Feet Long and 9 Inches in Diameter. Weight, 1200 lbs.

A New Swaging Machine.

A new form of swaging machine has been designed by the Manville Bros. Company of Waterbury, Conn., and is now ready for the market. As well known, swaging consists of hammering, by means of a mechanical device, wire, sheet, rod or tubing so that their thickness is reduced. The machine herewith illustrated is designed to operate upon wire. The swager proper is the same as that of the well known rotary machines now on the market. The work is done by a series of rolls mounted in a cage rotating at a high speed.

In this new machine, the wire enters through the double roll straightener, then passes through the feed grip into the cut-off quill at the extreme left where the wires are cut off to the right length and are dropped.



New Swaging Machine of the Manville Bros. Co. of Waterbury, Conn.

The machine is designed for swaging bicycle spokes, needles and many other varieties of work that are reduced in diameter. The main swaging spindle is driven by a belt. The other mechanism is driven by a pulley, worm-shaft and worm to the worm wheel passing through the pedestal. This shaft carries form cams which operate the feed, cut-off, binder and die controlling mechanism.

The length of the unswaged portion is regulated by the throw of a cam piece set into the main feed cam. With the various additional automatic mechanism that is used on the machine, it will readily be seen that a large variety of work may be accomplished on it. The wire is taken directly from the coil, straightened, swaged, cut to length and dropped in the finished condition without any handling.

A good flux for melting brass washings, grindings, etc., in which earthy matter is to be fluxed off, is a mixture of 3 parts of lime and 1 part of fluor-spar which gives excellent results.

The presence of "fire" in sterling-silver is caused by the formation of sub-oxide of copper during annealing or melting. Although sterling-silver may be free from "fire" when cast, subsequent annealing will introduce it unless carried out in a neutral or oxidizing atmosphere.

The "Rockwell" Stationary Crucible Melting Furnace.

A new stationary crucible melting furnace has recently been constructed and placed on the market by the W. S. Rockwell Company, 50 Church St., New York City. The furnace is herewith shown and has many valuable features.

In many instances, particularly in the case of small crucibles, the use of a tilting furnace is unnecessary or is not desired. This furnace is made to answer such requirements.

The "Rockwell" Stationary Crucible Furnace Using Oil or Gas for the Fuel.

The furnace is designed for use with oil, but gas of any kind may be employed if desired. The burner is on the top of the furnace and points downward, so that the flame is directed towards the bottom of the combustion chamber and not upon the crucible. This is an important feature as it prolongs the life of the crucible. The cover is easily raised and thrown to one side.

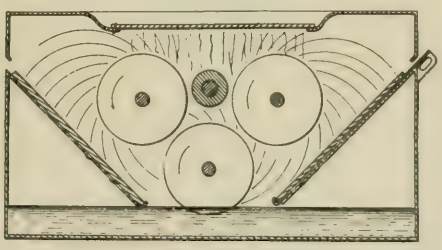
Standard shape crucibles are used (no special sizes are necessary) and sizes from No. 20 up to 200 may be used, according to the size of the furnace. In case the crucible breaks, the metal in the bottom may be tapped out and recovered.

Comparatively low air pressure is used and the burner is accessible at all times and easily regulated.

It is stated that the net cost of melting with this furnace is less than half that of coke, when everything is taken into consideration. This is an important feature and is worthy of consideration in all brass foundries. The fact that the crucible does not have to be poured into a ladle, but is carried directly to the mold, prevents loss of heat. In other words, the furnace is used in exactly the same manner as the ordinary coal or coke furnace but no pit is required as there are no ashes to wash.

Improved Apparatus for Etching Flat Plates.

In etching metals with any solution, it is necessary to provide a circulation of the etching liquid in order to produce a rapid attack of the metal and also to prevent under-etching. The circulation is usually accomplished in a mild manner by agitation or by rocking the container or by similar means. Axel Holmström of Gefle, Sweden, has constructed an etching apparatus that will provide a circulation without any danger of loosening the resist.



The Etching Apparatus.

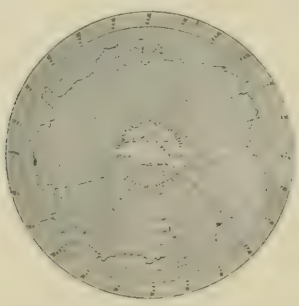
It consists of a tank for holding the etching solution, and is provided with revolving wheels to pick up the solution. It is carried from the two bottom wheels to the top one and then is sprayed to the face of the plate by the centrifugal action of this top wheel. In this manner a constant and mild spray is produced that will provide the necessary circulation and have sufficient force to remove the bubbles of hydrogen gas that are formed on the etched surface as the action goes on.

The practice of using a rod of tool steel in sterling silver to indicate the temperature (when it sparkles) has now practically passed out of existence as it has been found quite unsatisfactory. The temperature thus obtained is altogether too high. It also introduces steel nodules in the silver.

The "Bristol" Compensated Gas-Filled Recording Thermometers.

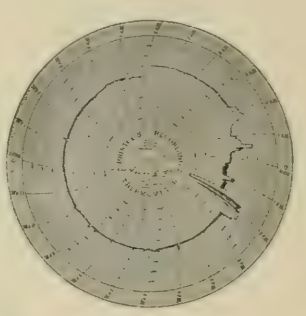
Scientists have long recognized the fact that an air or gas thermometer is the ideal type for low temperature measurement, provided the air thermometer can be manipulated in the laboratory where it is possible to make various corrections. Realizing this fact and that the making of the corrections in the laboratory is

unsuited for regular work, the Bristol Company of Waterbury, Conn., manufacturers of pyrometers and recording instruments, have now constructed a new gas-filled recording thermometer that has a compensating attachment so that all errors are rectified in the instrument. Such an instrument is shown in Fig. 1.



The instrument is so constructed that whatever changes in temperature there are at any point except the working end, no record is made and the only variation shown will be that of the substance itself that is being tested.

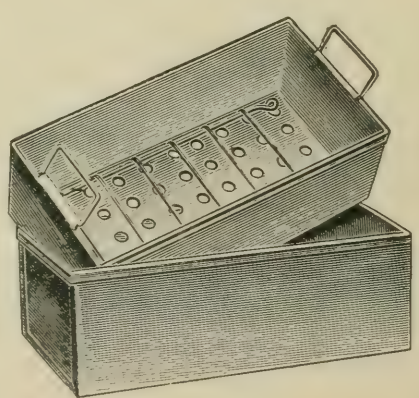
The instrument is useful for testing feed water, brine and similar liquids. In Fig. 2 is shown the record of feed water temperature while Fig. 3 indicates the chart obtained on condenser water. It will be noted that this chart has reverse graduations and is desirable



for this class of work on account of the average temperature being lower than 125 degrees.

An Electrolytic Cell for Cleaning Silverware.

The tarnish on silverware is nearly always sulphide of silver and the usual method of cleaning it is by scouring. This not only involves labor, but removes more or less of the silver and leaves scratches. In the *Wisconsin*



The Apparatus for Cleaning Silver by Galvanic Action.

Engineer, Dec. 1910, Prof. C. F. Burgess describes the electrolytic cell for cleaning silverware that is the invention of Messrs. Phillips and Hambuechen of the University of Wisconsin.

The principle of the cell lies in the fact that when the silverware comes in contact with zinc, a galvanic action takes place and hydrogen gas is liberated on the silver which reduces the sulphide and thus cleans it. For the electrolyte a solution of bi-carbonate of soda or sal-soda is employed.

The apparatus used is that herewith shown. It consists of a zinc dish (aluminum may also be used) and inside of it a tin container for holding the silverware. The solution of bi-carbonate of soda or sal-soda is poured into it and the silverware immersed in it. The cleaning takes place almost immediately. If used warm, the solution works better.

The tin container is not absolutely necessary, but it is employed for the reason that otherwise, the surface of the zinc dish would soon become dirty from the matter deposited upon it and then scrubbing would be required. Tin has the property (not possessed by many other metals) of having an over-voltage. A counter electromotive force is then set up which prevents the needless waste of zinc. Through the presence of the hydrogen gas, the tin is always kept clean and an insulating film does not form on it as it does upon the zinc when used with the silverware alone. There is, therefore, nothing to prevent a good contact from being made.

An Improved Mold for Casting Brass in Sand.

An improved mold for casting brass in sand has recently been patented by Frank J. Phillips of Chicago, Ill., (U. S. Patent 977,546, Dec. 6, 1910.) The method of making the mold is herewith shown. The manner in which the mold is made is given in the following description:

"The operation of molding differs from that usually employed in brass foundries that each compartment containing one of the gated patterns is filled with sand and separately rammed and then vented through the vent holes in the side walls of the flask. These flask members fit the patterns very closely, leaving but sufficient space between them and the walls of the flask and partitions to contain the minimum amount of sand, and they are so shallow that but a thin layer of sand covers the patterns. In this manner I save a large quantity of molding sand which at present is wasted, and also considerable time in the handling of the sand, the ramming of the same in the flask, etc.

After the patterns have been withdrawn from the flask, each flask member is placed in a bake oven where the sand is baked quite hard to eliminate therefrom all moisture so that when the two flask members are clamped together by suitable clamps, not shown, the mold is ready for pouring, where owing to the entire absence of moisture, and the peculiar venting, I produce castings of a superior quality practically free from imperfections and without any loss, at a much lower cost than what such castings have heretofore been produced.

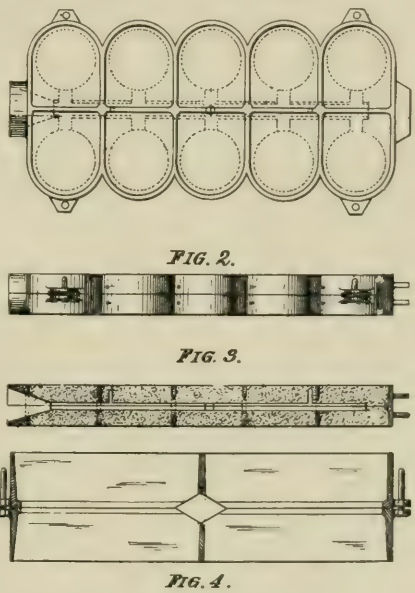


FIG. 2.

FIG. 3.

FIG. 4.

New Form of Flasks for Casting Brass at a Reduced Cost.

In carrying out this system of producing castings, I am enabled to employ less skilled help than what is now required to produce this class of work, in fact boys can be economically employed who after a very short practice will produce as many and as good castings as any skilled brass molder.

When the castings to be produced are very small, I may bunch a number of the patterns for the same in each compartment and proceed with the molding, venting, baking, setting cores, when required, and the pouring, the same as heretofore described."

Questions and Answers.

QUESTION No. 913. Will ammonia in a cyanide solution make it give a soft deposit? I use such a solution for plating iron tubing and the copper deposit is hard and streaky. The solution is used cold and stands about 16° Beaume'.

Answer. The ammonia will not give you what you want. Add about 2 oz. of sodium bi-sulphite and this will probably give you a better deposit. You will find, however, that if you run your cyanide copper solutions warm or hot that you will obtain far better results. The deposit is cleaner and brighter and covers the iron more rapidly. In case you use hot, you will not need to have the solution as strong.

QUESTION No. 915. What will be the effect of accidental introduction of a cyanide solution in a nickel plating solution? We are brass plating certain articles made of tubing, and we have reason to fear that a small amount of the brass cyanide solution has been carried over ito the nickel plating solution.

Answer. As far as the simple introduction of cyanide into the nickel solution is concerned, no particular harm can result as it will only make the solution alkaline and this is readily overcome by the addition of a small amount of sulphuric acid. It is the copper and zinc introduced that will do the harm. They will cause you nickel to came dark. If you find, when the solution is slightly acid to test paper, that your nickel deposit is coming dark, then the introduction of the brass solution is the cause.

QUESTION No. 916. What is the best deoxidizer for Monel-Metal? We have tried magnesium, cupro-vanadium, manganese and aluminum, but so far are never sure of a casting. For a flux, we use 3 parts of lime and 1 part of fluor-spar. The furnaces we use are coke fired with forced draught and we cast in sand.

Answer. For casting Monel-metal in sand you will find aluminum the best deoxidizing material. Follow the same method as used in casting steel. Use about 4 oz. of aluminum to 100 lbs. of Monel-metal. If you then fail to obtain good castings, the difficulty is in your melting. The flux you are using is quite satisfactory.

QUESTION No. 919 Is there any advantage in a very heavy nickel deposit? It is our impression that nothing is to be gained, and that a deposit of ordinary thickness gives all that is required.

Answer. Heavy nickel deposits, except in rare instances, are of no advantage. In fact, they are unsatisfactory. Nickel is so hard that a light deposit wears exceptionally well and is not apt to peel or flake off like a heavy deposit. By an ordinary deposit is meant one that is obtained in about one or two hours. Light deposits, of course, are obtained in from five to ten minutes, but these are usually too thin for the majority of work.

QUESTION No. 920. Is there a mixture called "brown-bronze" ? If so will you give the ingredients?

Answer. There is no mixture by this name. The brown bronzes are all colored superficially. All bronzes are bronze colored, yellow or red, as the case may be.

QUESTION No. 921. What is the difference between "banana-liquid" used for putting on bronze powder and brass lacquer?

Answer. There is no real difference, except the liquid used for putting on the bronze powder is not as heavy. It is also a much cheaper form and will hardly answer for lacquering metals. The common name for amyl acetate is banana oil on account of the odor being like that of bananas.

QUESTION No. 922. A condition exists in our foundry which we would like explained. Our brass foundry is located near the iron foundry and it is under the same roof as the machine shop and iron foundry. Lately we have had a number of our men taken sick during working hours and others were taken sick during the night. Some of the symptoms are aching of the muscles, chills, followed by copious sweating. The belief is common among the men that the sickness is caused by the brass foundry, and as it has occurred lately, it is attributed to the fact that the doors and windows are closed during the cold weather. We would like your opinion on the matter.

Answer. Your employees certainly have had attacks of spelter chills. They are caused by zinc fumes and, as you say, are apt to take place more in winter than in summer on account of lack of ventilation. The symptoms are those of the difficulty. While the chills are very disagreeable, they are not dangerous. A man may have one during the night and be able to go to work the next day without feeling any the worse for it. The best remedy, of course, is to remove the cause although in time a person will become immune. There is no particular remedy used. See THE BRASS WORLD, August, 1907, page 255 in which the whole matter of spelter chills is described.

QUESTION No. 923. How is perchloride of iron used in etching manufactured?

Answer. You will probably find it much cheaper to purchase the perchloride of iron for your work as it requires quite an equipment to make it in the manner that should be done. It is made in the following manner: Iron turnings, preferably, wrought iron or low carbon steel, are dissolved in muriatic acid until all the acid has been saturated. To do this, it is necessary to have an excess of iron and to warm the solution. It is used in a porcelain or glass vessel. When all the acid has been saturated with iron, the solution is filtered. A solution of ferrous chloride is now obtained (iron protochloride) while the perchloride is the ferric chloride. To

change the ferrous to the ferric chloride, chlorine gas is passed in to the solution until saturated. This produces the change. The solution is now evaporated to dryness when the yellow lumps of perchloride of iron will be obtained. If it contains free acid it is not suitable for etching.

QUESTION No. 924. Please give us a formula for anti-acid metal to be used in a bronze casting for a mining pump, including the body, seats, lining, etc. The metal must resist the action of sulphuric acid that is in the water, and yet be a good wearing metal for this purpose.

Answer. While a bronze containing a large quantity of lead will resist the action of the acid water to a satisfactory degree, you cannot use a large amount on account of the weakness of the bronze mixtures containing it. The following mixture, however, will be found excellent, and while it contains some lead, there is not enough to seriously weaken the metal.

Copper	85 lbs.
Tin	5 lbs.
Lead	5 lbs.
5% Phosphor-Tin	5 lbs.

Use no zinc at all in the mixture or you will injure it for your work.

QUESTION No. 925. We are having considerable trouble with our brass solution. We are plating steel studs and nuts and the solution is used cold. We do not seem to obtain a sufficiently heavy or bright deposit. We do not wish to run a hot solution. Can you give us any information as to how to run the solution so as to obtain a heavy deposit and still have it bright? We first copper plate the goods, then buff and finally brass plate 45 minutes.

Answer. You do not say how strong your solution is. It may be too weak. If so the deposit will form very slowly. In this case strengthen it by the addition of more copper and zinc. It may be possible, too, that your anodes are not clean and that you are not obtaining the full value of the current. Scrub the anodes frequently as they soon become covered with a scum or coating that impedes the passage of the current. It may also be caused by the solution being too cold. In winter solutions become quite cold and no plating solutions work well under such conditions. The remedy is to warm them. As far as a bright deposit is concerned, you can produce the brightness by the addition of a small amount of arsenic to the solution, but unless you are familiar with the process you may need instruction. See THE BRASS WORLD, Dec. 1909, page 425. If you are to buff the brass deposit, do not use any arsenic. It then does no good.

QUESTION No. 926. We have sent you a yellow brass casting which is giving us some little trouble in making. The mixture is 65% copper and 35% zinc. The casting is put under hydraulic pressure of about 20 lbs. per sq. in. and we would like to know whether it is possible to make them so that they will not leak. We find quite a number leak when tested.

Answer. The casting seems to be well made, but has the appearance of having a small quantity of aluminum in it. This will cause the castings to leak under pressure The walls of the casting, too, are rather thin. Yellow brass will not stand pressure, without leaking, in the manner that red metal will. In making steam metal valves from the best red metal, the leakage runs from 5 to 15 per cent. If you are not having any more leakage than this in your yellow brass you are very lucky. You cannot cast yellow brass without having a large percentage of leakage in the form of casting you have. Keep aluminum out of it and you will have a much smaller number.

QUESTION No. 927. We are interested in finding a method of etching aluminum cheaply. How can it be done?

Answer. You do not say what class of material you desire to etch. The cheapest form of etching is known as the "rubber stamp process" and this can be done on any metal. The process of producing the design on the metal in the form of a resist is the same whatever metal is used and the only difference will be in the etching liquid. You will have to use muriatic acid for etching the aluminum as nitric acid will not act upon it. Use 4 parts of water and 1 part of acid and if it works too slowly add more acid. Perchloride of iron may also be used. You will not be able to obtain a very smooth etch on aluminum on account of the nature of the metal.

QUESTION No. 930. I have an order for cast Tobin-bronze stems to make. Is the following mixture right: 7¼ lb. copper, 2 lbs. zinc, 1 lb. tin and ½ lb. lead? What is the difference in strength between 88 copper, 10 tin and 2 zinc, and Tobin-bronze?

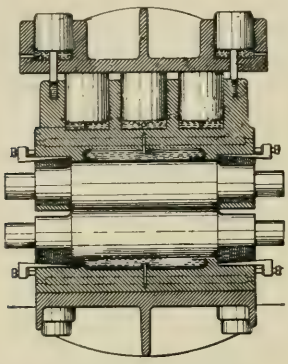
Answer. The mixture you name for Tobin-bronze is far from the standard. The one employed for rolled rods, is practically the following: Copper 60%, zinc 49% and tin 1%. It is unsuited for sand casting, however, and you should add a little aluminum to it to give it the necessary casting qualities. Tobin-bronze has never been used for sand castings but is made in the form of rolled rods and sheet metal. It then has over twice the strength of the 88-10-2 mixture you mention.

QUESTION No. 931. I am having a little trouble with my nickel solution. The color of the deposit is very dark. I use ¾ lb. of double salts and ¾ oz. single salts. The work is done in baskets. The solution is not acid as far as litmus paper is concerned. What is the reason for the dark deposit?

Answer. We should judge that your solution is alkaline from your description. Add ⅛ oz. of boracic acid to every gallon and also 1 oz. of sal-ammoniac. Then see if you have good connections in your basket. Try on a piece of work hung in with a wire, and if it deposits white nickel, then the difficulty is in the basket connections.

Patent Abstracts.

977,725, Dec. 6, 1910. ROLLING MILL. Alfred Gautschi of Menziken, Switzerland. Assignor to Aluminumwaaren-Fabrik Gontenschwil, Aktiengesellschaft of Gontenschwil, Switzerland. The mill is designed so that hydraulic pressure is applied to the middle of



the rolls to prevent their springing. The novelty of the invention, however, lies in the use of devices for preventing the entrance of foreign matter between the roll and the pressure member.

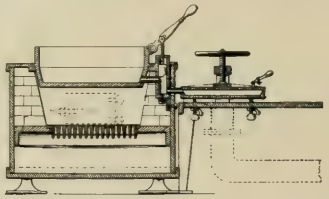
977,453, Dec. 6, 1910. SAND BLAST DEVICE. Albert Jorn, Jr., of Waukegan, Ill A device for feeding the sand to the air blast, a novel arrangement of deflectors being used to guide the sand in the proper manner.

977,984, Dec. 6, 1910. GRAPHITE ARTICLE AND METHOD OF MAKING THE SAME. Frank J. Tone of Niagara Falls, N. Y. A method of making graphite articles by taking electrically produced graphite and subjecting to pressure in a mold.

978,146, Dec. 13, 1910. ELECTRIC FURNACE. Charles Fery and Charles Langlet of Paris, France. An electric resistance furnace in which the parts are so made that they

will expand equally when heated, thus obviating the usual fault of such furnaces in opening at the joints and allowing air to enter.

976,856, Nov. 29, 1910. APPARATUS FOR BACKING ELECTROTYPE PLATES. George E. Dunton of New York City. A device for pouring the soft metal backing into copper electrotype shells. The metal is forced



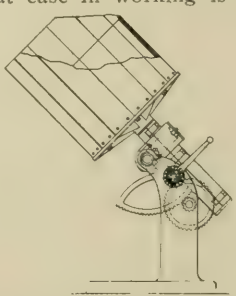
out of the melting pot by means of a plunger. The object is to obtain a uniformly adherent and sound backing to the electrotype plate.

978,212, Dec. 13, 1910. PROCESS OF REFINING COPPER. Walter S. Rockey and Hilliary Eldredge of New York City. A method of refining copper by melting boracic acid in a crucible, then adding the copper and allowing it to melt, and finally allowing the whole mass to cool in the crucible with the boracic acid on the top. In this manner, it is claimed that the copper will be comparatively free from impurities.

977,271, Nov. 29, 1910. LADLE FOR POURING METAL. James W. Callaghan of Newark, N. J. A bottom poured ladle in which the closing mechanism is entirely outside of the ladle, thus preventing the usual difficulties with the stopper.

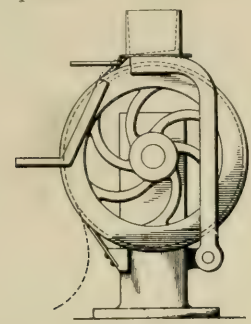
978,418, Dec. 13, 1910. ELECTRICAL SPOT WELDING MACHINE. Wm. C. Winfield of Warren, Ohio. Assignor to the Winfield Electric Welding Company. A machine for the electric welding of sheet metal in spots or portions desired.

978,524, Dec. 13, 1910. TUMBLING BARREL. Frederick E. Warner of Bridgeport, Conn. An oblique tumbling barrel so constructed that ease in working is obtained to



the maximum degree. One feature is the use of a brass lining which is so constructed that it may be cast in one piece. When worn, therefore, it may be easily replaced.

978,040, Dec. 6, 1910. PROCESS OF MAKING SOLDER RINGS. Edward M. Lang, Jr., of Portland, Maine. A machine or device for making rings of solder used for hemming caps. The process is intended to obviate the



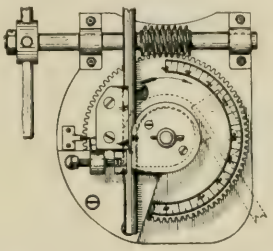
need of making them from sheet with the accompanying excessive waste. A strip or ribbon of solder of the desired uniform thickness, is formed into a ring of curved cross section. The machine is constructed for producing it. In this manner there is practically no waste in scrap metal.

978,652, Dec. 13, 1910. METHOD OF MAKING HANDLES FOR LADLES. James B. Rodger of Harvey, Ill. Assignor to the Whiting Foundry Equipment Co. of the same place. A method of making handles for foundry ladles. The handle is made in one piece so as to reduce the waste in manufacture and also produce a strong article that will not break in use.

978,846, Dec. 20, 1910. METHOD OF MAKING SEAMLESS WIRE. Thomas F. Carlisle of Providence, R. I. Assignor to the Improved Seamless Wire Co., of that city. A method of making seamless wire for use in making ornamental chain links, etc. The

process is applied to wire containing a core of solder and the method is to make the core of several layers so that, when the wire is cut and the ends abutted for soldering, the solder will give a uniform and continuous joint upon heating.

977,196, Nov. 29, 1910. TUBE BENDING MACHINE. Richard Kieserling Sr. of Cincinnati, Ohio. A device for the bending of pipe or tubing. The tube or pipe is bent with-

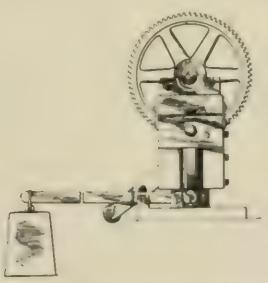


out filling and the following of the bend by means of the bending die prevents the flattening.

978,782, Dec. 13, 1910. GAGGER OR SAND ANCHOR. Guy S. Rinebolt of Franklin, Pa. Assignor to the Franklin Core Rod and Gagger Co., of the same place. The gagger is made of twisted iron bent in the necessary shape to fit the flask. The spirally twisted rod is said to hold in an excellent manner.

978,747, Dec. 13, 1910. ABRASIVE ARTICLE. Francis W. Higgins of Niagara Falls, N. Y. Assignor to the Carborundum Company of the same place. The patent is upon a binder for use in making carborundum wheels and similar products. It has been found that fluorides produce a strong binder and the following mixture is employed: Carborundum 76%; quartz 12.25%; kaolin 8.25%; fluor-spar 1%; and sodium-aluminum fluoride 2.5%. The carborundum and quartz are pulverized to the fineness desired in making the wheel.

979,297, Dec. 20, 1910.. MACHINE FOR MAKING FINGER RINGS. Henry Heinrich of New York City. A machine for making gold finger rings and which has been so



designed that the tendency to distort the ring is reduced to a minimum. The construction of the machine may be understood from the illustration.

Trade Items.

The Marsh Valve Co., has been incorporated in Dunkirk, N. Y., with a captital stock of $250,000 to manufacture radiator valves. The office of the company is at 305 Central Ave., Dunkirk, N. Y.

The Taunton-New Bedford Copper Co., Taunton, Mass., manufacturers of rolled copper, are now carrying on electroplating and have recently installed a plating barrel for plating brass nuts, screws, washers, etc.

John C. Blevney, manufacturer of automatic polishing machines, is sending out a circular to the trade announcing that he is now located in his new factory at 209 Parkhurst St., Newark, N. J. His former factory on High St., was destroyed by recent fire in that city.

The American Detinning Co., has been organized in Connellsville, Pa., to carry on detinning. The organizers are R. S. Wile, C. E. Houston, A. B. Norton, Jr., R. K. Long, Otto Stickel, K. K. Kramer and J. F. Kurtz, all of Connellsville.

Charles P. Mebane has purchased the entire interest of the Allyne Brass Foundry in "Homogen" the flux that they have been selling for some time. A new company called the Homogen Manufacturing and Supply Co., has been formed in Cleveland, Ohio, and will manufacture and market the material as before.

The Hoyt Electrical Instrument Works of Penacook, N. H., manufacturers of voltmeters and ammeters, have found it advisable to close their sales office that has been maintained at 161 Summer St., Boston, Mass. All business transacted there will now be handled from their factory or from their New York office at 136 Liberty St.

The Pacific Plating Co., 145 West Railroad St., Los Angeles, Cal., manufacturers of builders hardware, has just closed a very successful year and will at once begin work upon an extension to its plant. The capital stock will be increased to $100,000. A new name will also be selected for the company as it is believed that the present name does not indicate the character of the business carried on.

The Roessler & Haaslacher Chemical Co., 100 William St., New York City, are now placing upon the market sodium cyanide of 128 to 130 per-cent cyanide equivalent. This is the first time that this material has been placed for sale in this country at a price that will save money for the user. When it is known that 100 lbs. of the sodium cyanide will do the work of 129 lbs. of ordinary potassium cyanide, cyanide users immediately become interested. This is explained by the atomic weight of sodium being lower than that of potassium so that if it takes 129 lbs. of potassium cyanide to dissolve a certain quantity of carbonate of copper, 100 lbs. of sodium cyanide will also dissolve it.

The plant of the Gabriel Horn Mfg. Co., East 40th. St., Cleveland, Ohio, manufacturers of automobile horns, was totally destroyed by fire on Dec. 10th. with a loss of about $50,000. It is stated that the plant will be rebuilt.

The Standard Rolling Mills, 363 Hudson Ave., Brooklyn, N. Y., manufacturers of rolled britannia metal and similar sheet metal goods, have now incorporated their company under the name of the Standard Rolling Mills, Inc. The business of the company will remain the same.

The Westminster Metal & Foundry Company has been started in Westminster, Md., and are now carrying on the manufacture of ingot bronze, brass and babbitt-metals. Oscar D. Gilbert is the president of the company; Geo. H. Atmacost, treasurer; and A. V. Moore, general manager. A small blast furnace, water jacketed, is now being run and copper bearing material is smelted in it.

The plant and business of the Wing & Parsons Mfg. Co., of Adrian, Mich., manufacturers of iron toys and hardware specialties, has been purchased by the Standard Hardware Mfg. Co., of that city. The business will be continued, but it is yet undecided whether the plant will remain in Adrian or moved to another location. Electroplating is carried on.

The Traut & Hine Mfg. Co., of New Britain, Conn., which has manufactured buckles, garter fasteners and a similar line of sheet metal goods for many years, have now commenced the manufacture of high grade plated jewelry. E. B. Miller, formerly with the North & Judd Mfg. Co., of New Britain, Conn., has taken charge of the plating department in this line.

It has been demonstrated again and again that Lycopodium, the natural pollen of a Russian plant, is the best parting material for brass foundry use. This is indicated by the fact that practically every maker of high grade brass castings uses it. Thomas M. Curtius, 5 Platt St., New York City, is the representative of Wm. Pollitz & Co., and supplies their material in full weight, original packages.

The Fulton Brass Foundry Company of South Bend, Indiana, manufacturers of brass, bronze and aluminum castings, as well as the various white metals, have begun improvements on the new building recently obtained by them. This building was formerly occupied by the Edmonson Concrete Machinery Co. This new foundry is located at Williams St. and Indiana Ave., and when completed the business will be moved from 447 Vistula Ave., where they are now located. The capacity of the company will then be increased five times. F. H. Fulton is the president and manager of the company.

The Swenson Valve Co., of Decorah, Iowa, valve manufacturers, are installing molding machines in their foundry which will enable them to increase their output. When in operation, their capacity will be doubled.

The Gamon Meter Company, 280 South St., Newark, N. J., manufacturers of water meters and brass founders, are to build a new plant. It will be 30 x 208 feet and two stories high.

The Rome Brass & Copper Co. of Rome, N. Y., have declared a stock dividend of 300 per cent, increasing its capital stock from $300,000 to $1,200,000. It will also sell $200,000 of new stock making the total capital $1,400,000.

The Butterworth-Judson Company of Newark, N. J., are one of the largest manufacturers of acids and their by-products in the United States and desire to correspond with concerns who are users of such classes of goods. They have been in business for over 30 years and have always had a reputation for high class goods. They wish to quote prices to all interested.

The equipment for the new brass foundry of the N. T. R. R. shops at Transcona, near Winnipeg, Manitoba, has been purchased. Among the large amount of material purchased are melting furnaces, crucible tongs, shanks, core ovens, molding machines and other necessary appliances. The railroad company will make their own brass castings at the new shops.

The plant of the Utica Aluminum & Novelty Works at Utica, N. Y., has been absorbed by the Aluminum Specialty Co., and will be moved to Fulton, N. Y. A factory formerly occupied by the American Tobacco Co., has been obtained and extensive facilities will now be had for manufacturing. The capital stock is $75,000 of which $40,000 has been paid in. The manufacture of aluminum novelties and staple products will be carried on.

Robert Kann, who some time ago established a laboratory for analytical work, announces that he has formed a partnership with R. J. Wyser and the scope of the laboratory will be extended. Mr. Wyser has been connected with the Carnegie Steel Co., for a number of years. The new firm has established itself at 62-64 Gold St., New York City and will carry on metallurgical work and sampling.

The Backus & Leeser Company, recently organized at 410-412 West 13th. St., New York City, report an excellent business up to the present time. In addition to carrying the regular line of polishing and plating supplies and equipment, they represent the Harshaw, Fuller and Goodwin Co., of Elyria and Cleveland, Ohio, the Eager Electric Co., of Watertown N. Y., the Keystone Emery Co., of Frankford, Pa., and the Diamond Machine Co., of Providence, R. I. Their connections are such, therefore, that they are able to supply the highest grade of materials found on the market.

The Bunting Brass & Bronze Company of Alliance, Ohio, brass and bronze founders, have begun the purchase of equipment for their new foundry to be erected in Toledo, Ohio. A 5 ton crane is to be erected in their plant which will give them the capacity for making large castings.

A new five story building is to be erected by Shapiro & Aronson, 24 Martin St., Brooklyn, N. Y., manufacturers of gas and electric fixtures and brass founders. This building will be 100 x 100 feet and of concrete. New equipment will be purchased and it is estimated that the building will cost $80,000 while the equipment will cost $20,000.

Rockhill & Vietor, 114 John St., New York City, announce to the trade that they have appointed the Bennett-O'Connell Co., 15 South Canal St., Chicago, Ill., their exclusive Western agents for their "Nonesuch" mechanical electroplating apparatus. They also announce that their sales are rapidly increasing and have so far been exceptionally flattering.

P. J. A. Douglas of Dartmout, Nova Scotia, claims to have discovered a process for tempering copper and other non-ferrous metals. A flexibility and uniform temper is claimed. It is stated that metals so treated will take a cutting edge. Castings of them are said to be cheaper than forgings. E. E. Cleveland of Chester, Nova Scotia is interested in the process.

The Gorham Mfg. Co., of Providence, R. I., recently completed the most elaborate silver dinner service ever made in this country. Its value is $120,000. The service consists of 900 pieces of silver with a gold lining. It was made for former Senator Clark of Montana, the so-called "Copper King" and will be used in his new $7,000,000 house on Fifth Ave., New York City.

The Globe Machine & Stamping Co., Cleveland, Ohio, are now placing on the market a new form of tumbling barrel for use in burnishing small metal goods by tumbling with steel balls. This barrel has been designed particularly for this purpose and the best results are obtained by using it. It has already been demonstrated that in order to obtain the best results in burnishing by means of steel balls, the barrel must be designed for the purpose.

When in need of sand-blasts (and many establishments should have them that are not now equipped), they can be found with all the latest improvements at Leiman Bros., 62K John St., New York City. These sand blasts are continuous feed and cannot clog up. They are also dust-proof. The sand is used over and over again. This company also make 8 sizes of blowers for use with sand blasts or other appliances requiring an air blast so that any kind of work can be done with them. The blowers are noiseless and powerful and cannot get out of order. Their new polishing and dust-collecting machine is now giving the best of satisfaction and a large number have already been sold.

The Lake Superior Brass Foundry Co., has been incorporated at Laurium, Mich.

The Sunray Stove Co., of Delaware, Ohio, which recently decided to move their plant to Tulsa, Oklahoma, will build a new plant in the latter city.

Marshall I. Smith, Bristol, Conn., manufacturer of light hardware, is to move his plant to Hartford, Conn. Quarters have been obtained in the Industrial Realty Building on Market St.

The Loeb Electrochemical Co., recently organized by Walter R. Loeb, has moved from 20 John St., to 467 Greenwich St., New York City where more extensive facilities have been obtained. The entire loft has been taken and the manufacture of plating and polishing supplies will be carried on in a more extensive manner.

The W. S. Rockwell Company, 50 Church St., New York City, are sending out their new catalogue No. 12 describing the "Rockwell" Stationary Crucible Melting Furnace. This furnace may be used with large or small crucibles and with oil or gas for fuel. The furnace will be found advantageous in many instances in which tilting furnaces are not desired.

The plant of the New Haven Sherardizing Co., 1040 State St., New Haven, Conn., has now been in successful operation for some time, and is the only plant in the East that makes a specialty of jobbing work. The fact that Sherardized goods have been found exceptionally rust proof has been instrumental in bringing the company a large number of orders. Any concerns that desire their iron or steel goods given a rust proof finish should correspond with them. They also install plants for the production of this coating.

The Blake & Johnson Company of Waterbury, Conn., have a reputation for making nothing but exceptionally high class machinery for working sheet metals and wire. Their appliances are found in all the leading establishments. They make a full line of mills for rolling sheet metal, and have recently placed on the market a new mill for rolling flat wire in brass, copper, bronze, silver, gold, aluminum and other metals. It is self contained and information will be supplied upon request.

Chas. F. L'Hommedieu & Sons Co., 24-26 South Clinton St., Chicago, Ill., manufacture an exceptionally complete line of plating and polishing supplies and equipment. It would be difficult to find anything needed in a plating shop that they do not handle. They are now placing on the market their No. 9 polishing lathe that is adapted for heavy use, and manufacture dynamos for every kind of work. Their "Reliance Plating Barrel" has been placed in many establishments where it is giving the best of satisfaction. It is of the oblique type and small quantities as well as large ones may be plated with equal facility. The smallest kind of goods, such as pins or eyelets, can also be plated in it.

The Star Brass Co., of Kansas City, Mo., have moved their plant from 21st. and Campbell Sts., to 18th. St., and Baltimore Ave.

A fireproof addition to the plant of the Lumen Bearing Co., at Toronto Junction, Canada is to be made. This is the second addition to be made within a short time and when the new building is completed, it will give them 1,100 sq. feet more of floor space.

The plant of the Dwasco Mfg. Co., has been removed from Holland Point, N. Y., to Canandaigua, N. Y., where their facilities for the manufacture of plumbers' brass goods have been greatly increased. One of the principal products of the company is brass fittings for water closet tanks.

The New Jersey Smelting & Refining Co., of Newark, N. J., which has heretofore confined its business to the smelting and refining of gold and silver sweeps, are now handling copper bearing material and lead drosses. Eight new furnaces have been added. Clarence Curran is the manager of the company, which is located at 121 Clifford St.

The U. S. Electro Galvanizing Co., No. 1 Park Ave., Brooklyn, N. Y., are announcing, in their new advertisement, that a reward will be offered for information in regard to any infringements of their plating and electro-galvanizing appliances that can be obtained. Full information will be given by writing to them.

Wm. A. Rogers, Ltd., of Niagara Falls, N. Y., manufacturers of silver plated ware, has obtained an injunction against the Knickerbocker Silver Co., of Port Jervis, N. Y. restraining them from using the name of Rogers or the letter "R" upon their goods. A complaint has been filed against the P. A. Coon Silver Mfg. Co., of Syracuse, N. Y., alleging the same infringement.

The No-Dust Drying Machine Company, 40 Clifford St., manufacturers of machines for drying-out metal goods, announce that the "No-Dust Drying Machines are Making Good." This is the result of an investigation among their customers and is, in reality, the customers' verdict. These machines are used for drying-out metal goods after plating, coloring or dipping and no-sawdust is used. The goods are rapidly and efficaciously dried out. Wherever used, the purchaser has become enthusiastic.

The name of the Bennett-O'Connell-Stevens Co. of Chicago, Ill., has been changed to the Bennett-O'Connell Company. The office and factory of the company remains at 15-17 South Clinton St., Chicago, Ill., and with the exception of the change in name, everything remains the same. This company is one of the largest manufacturers of plating and polishing supplies and equipment and now carries everything needed in the plating room, both in supplies and equipment. They are now the exclusive Western selling agents of Rockhill & Vietor for their "Nonesuch" plating machine, and also represents the American Lacquer Co., of Bridgeport, Conn.

The Avondale Cutlery Co., has been incorporated in East Nutley, N. J., with a capital stock of $125,000 to manufacture cutlery.

The Rockwell Furnace Co., 26 Cortlandt St., New York City, have acquired the exclusive right to manufacture and sell the Moyer tramrail.

An addition to the plant of the Youngstown Bronze & Foundry Co., Youngstown, Ohio, will shortly be made. It will be located on Maumee St., and the cost is to be $1,500.

The Superior Bronze Co., has been incorporated in Pittsburgh, Pa., with a capital stock of $15,000. The company is located at 4042 Liberty Ave.

A new firm, called Robert E. Lee & Co., has been organized in Newark, N. J., to carry on electroplating. The factory is at 13 Franklin St., in that city.

The factory of the Ely Mfg. Co., of Girard, Pa., manufacturers of hardware specialties, was damaged by fire on Dec. 17th, to the extent of $30,000.

The Komposite Metal Co., has been organnized in Philadelphia, Pa., to manufacture bearing metals. The office of the company is in the Land Title Bldg.

The Hoyer Metallic Packing Co., has been organized in Milwaukee, Wis., with a capital stock of $30,000. A. E. Martin, 391 Thirteenth St., is the principal organizer.

George S. Youngs, Housatonic Ave. and Stella St., Bridgeport, Conn., manufacturer of brass and composition ingot metals, has sent to his customers a very attractive calendar.

The Richards Mfg. Co., and the Wilcox Mfg. Co., of Aurora, Ill., both manufacturers of builders hardware, have consolidated under the name of the Richards-Wilcox Mfg. Co. The same lines of goods will be carried on.

The Knickerbocker Foundry Co., 348 West 12th. St., New York City, has commenced the manufacture of gold, silver, brass, bronze and aluminum castings. A specialty will be made of automobile castings. Louis Schwartz is president of the company and A. P. Chavent vice-president and treasurer.

The Duplex Adding Machine Co., St. Louis, Mo., manufacturers of adding machines, have taken quarters in the three story building at 1900 Morgan St., where the manufacture of their machines will be commenced. It is expected that several hundred hands will be employed.

The Hanson & Van Winkle Co., of Newark, N. J., are now manufacturing a number of different grades of lacquers and which are adapted for the various finishes and metals. Their Bulletin No. 110 describes them and will be sent to anyone interested. The recent products of this company are "Kostico" for cleaning metals preparatory to plating, "Pickelene" to take the place of acids for pickling, "Capstone" nickel salts for plating barrel use, and black nickel salts No. 2. They also issue information about these products.

The plant of the National Hardware Company at Orillia, Ont., Canada, manufacturers of locks, is to be enlarged.

The American Platinum Works of Newark, N. J., have moved to 225 Railroad Ave., in their new building.

The Standard Enameling and Plating Co., has moved from 159 Orange St., Providence, R. I., to 50 Bagley St., Pawtucket, R. I.

The Gurney Scale Co., of Hamilton, Ont. Canada, scale manufacturers, have commenced the construction of their new plant in that city.

The new plant of the Incandescent Light & Stove Co., at Oakley, Ohio is rapidly being completed. It is expected that it can be occupied by spring.

The Curtiss Aeroplane Co., has been incorporated at Hammondsport, N. Y., with a capital stock of $20,000, to manufacture aeroplanes.

Two shares of Tiffany & Co., the well known jewelers of New York City, recently were sold at auction for $5,700. The capital stock of the company is $2,400,000. The par value of the stock is $1,000.

The Oven Equipment & Mfg. Co., of Stamford, Conn., manufacturers of japanning and enameling ovens and gas burners, will erect a new factory in New Haven, Conn. Victor Morris Tyler is the president of the company. The building will be of brick and 60 x 200 feet, two stories high.

Personal.

Wm. P. Eckfeldt, formerly with the Zucker & Levett & Loeb Company, is now associated with the Hanson & Van Winkle Co., of Newark, N. J., and will represent them in Eastern Pennsylvania.

H. D. Cole, who has been with the Jonathan Bartley Crucible Company of Trenton, N. J., since their organization, is now representing them in the Eastern states and will shortly make his headquarters in New England.

H. R. Linton, who has been general manager of the Centre Foundry & Machine Company of Wheeling, W. Va., has been elected general manager of the Keewanee Foundry & Mfg. Co., of Keewanee, Ill. This company is erecting a new plant in that place.

Obituary.

Edward Balbach Jr., president of the Balbach Smelting & Refining Co., of Newark, N. J., died on Dec. 30th., at the Hotel Savoy in New York, aged 72. He was born in Carlsruhe, Germany, and established the business with his father in 1851. The company is one of the largest of its kind. Mrs. Edward Randolph, wife of the general manager of the company, is his daughter.

Current Metal and Supply Prices.

These Prices are net and are for moderate quantities. Smaller quantities command higher prices. Prices subject to fluctuation.

Acetone, pure, 98-99%	lb.	.22
Acid, Acetic, pure, 30%	lb.	.07
Acid, Arsenious (White Arsenic)	lb.	.20
Acid, Benzoic	lb.	.55
Acid, Boracic (Boric), pure	lb.	.12
Acid, Hydrochloric, see Acid, Muriatic.		
Acid, Hydrofluoric, 30%	lb.	.04
Acid, Hydrofluoric, 50%	lb.	.10
Acid, Muriatic, 20°	lb.	.02
Acid, Muriatic, c. p., 20°	lb.	.07
Acid, Nitric, 38°	lb.	.05⅝
Acid, Nitric, 40°	lb.	.05⅞
Acid, Nitric, 42°	lb.	.06¼
Acid, Nitric, c. p.	lb.	.08
Acid, Sulphuric, 66°	lb.	.01¾
Acid, Sulphuric, c. p.	lb.	.06
Alcohol, Wood	gal.	.50
Alcohol, Denatured	gal.	.55
Alum	lb.	.04
Ammonium Sulphate	lb.	.07
Aluminum, Metallic, in Ingots	lb.	.22
Aqua-Fortis, see Acid, Nitric.		
Ammonia Water (Aqua-Ammonia), 20°	lb.	.04¾
Ammonia Water (Aqua-Ammonia), 26°	lb.	.06¼
Ammonia Water, c. p.	lb.	.08
Ammonium Carbonate, lump	lb.	.15
Ammonium Chloride (Sal-Ammoniac)	lb.	.12
Ammonium Hydrosulphuret	lb.	.30
Ammonium Sulphate	lb.	.07
Ammonium Suphocyanate	lb.	.50
Amyl Acetate	gal.	1.85
Antimony	lb.	.07½
Arsenic, Metallic	lb.	.15
Arsenic, White (Acid Arsenious)	lb.	.20
Argols, White (Cream of Tartar)	lb.	.31
Asphaltum, Commercial	lb.	.05
Asphaltum, Egyptian (Bitumen)	lb.	.30
Benzine	gal.	.15
Benzol, Pure	gal.	.75
Bismuth, Metallic	lb.	2.00
Bitumen, see Asphaltum.		
Blue-Vitriol, see Copper Sulphate.		
Borax, Crystals or Powdered	lb.	.10
Borax Glass	lb.	.35
Cadmium, Metallic	lb.	.70
Carbon Bisulphide	lb.	.10
Calcium Carbonate (Precipitated Chalk)	lb	.10
Chrome-Green	lb.	.50
Copper, Lake, (carload)	lb.	.12⅞
Copper, Lake, (cask)	lb.	.13⅛
Copper, Electrolytic, (carload)	lb.	.12¾
Copper, Electrolytic, (cask)	lb.	.13
Copper, Casting, (carload)	lb.	.12½
Copper, Casting, (cask)	lb.	.12¾
Copper Acetate (Verdigris)	lb.	.35
Copper Carbonate, dry	lb.	.25
Copper Sulphate (Blue-Stone)	lb.	.09
Copperas, see Iron Sulphate.		
Corrosive Sublimate, see Mercury Bichloride.		
Cream-Tartar, see Potassium Bitartarate.		
Cryolite	lb.	.12
Cyanide, see Potassium Cyanide.		
Dextrin	lb.	.15
Emery Flour	lb.	.04
Emery, F F & F F F	lb.	.03
Flint, powdered	lb.	.01
Fluor-Spar	lb.	.01¼
Fusel-Oil	gal.	1.75
Gold Chloride	dwt.	.60
Gum Copal	lb.	.30
Gum Guiacum	lb.	.26
Gum Mastic	lb.	.70
Gum Sandarac	lb.	.35
Gum Shellac, brown	lb.	.50
Gum Shellac, white	lb.	.60
Iron Perchloride	lb.	.25
Iron Sulphate (Copperas)	lb.	.05
Lead Acetate (Sugar of Lead)	lb.	.15
Lead, Pig	lb.	.04½
Lead, Red	lb.	.12
Lead, Yellow Oxide (Litharge)	lb.	.12
Liver of Sulphur, see Potassium Sulphide.		
Manganese, Ferro, 80%	lb.	.10
Manganese, Metallic, pure	lb.	.75
Magnesium, Metallic	lb.	1.50
Mercury Bichloride (Corrosive Sublimate)	lb.	.93
Mercury, Metallic (Quicksilver)	lb.	.46
Mercury Nitrate	lb.	1.50
Mercury Oxide, yellow	lb.	1.80
Nickel and Ammonium Sulphate (Double Salts)	lb.	.16
Nickel Carbonate, dry	lb.	.60
Nickel Chloride	lb.	.50
Nickel Metallic	lb.	.47
Nickel Sulphate (Single Salts)	lb.	.25
Nitre (Saltpetre), see Potassium Nitrate.		
Oil of Vitriol, see Acid, Sulphuric.		
Paraffine	lb.	.15
Phosphorus, yellow	lb.	.40
Phosphorus, red	lb.	1.10
Pitch	lb.	.05
Plaster of Paris, Dental	bbl.	4.00
Platinum Chloride	oz.	20.00
Platinum Metallic	oz.	41.00
Potash-by-Alcohol, in sticks	lb.	.50
Potash, Caustic (Potassium Hydrate)	lb.	.08
Potassium Bichromate	lb.	.14
Potassium Bitartarate (Cream of Tartar)	lb.	.31
Potassium Carbonate (Pearlash)	lb.	.10
Potassium Chlorate	lb.	.15
Potassium Cyanide	lb.	.25
Potassium Iodide	lb.	2.25
Potassium Nitrate (Nitre or Saltpetre)	lb.	.10
Potassium Permanganate	lb.	.17
Potassium, Red Prussiate	lb.	.60
Potassium, Yellow Prussiate	lb.	.24
Potassium Sulphide (Liver of Sulphur)	lb.	.15
Potassium Sulphuret, see Potassium Sulphide.		
Potassium Sulphocyanate	lb.	.70
Pumice, Ground	lb.	.05
Quartz, Powdered	lb.	.01
Rosin, Yellow	lb.	.04
Sal-Ammoniac, see Ammonium Chloride.		
Sal-Soda, see Sodium Carbonate.		
Silver Chloride, dry	oz.	.75
Silver Cyanide	oz.	1.00
Silver, Fine	oz.	.55
Silver Nitrate, crystals	oz.	.50
Soda-Ash	lb.	.05
Sodium Biborate, see Borax.		
Sodium Bisulphite	lb.	.15
Sodium Carbonate (Sal-Soda), crystals	lb.	.02
Sodium Hydrate (Caustic Soda)	lb.	.05
Sodium Hydrate (Caustic Soda) by Alcohol (in sticks)	lb.	.45
Sodium Hyposulphite ("Hypo")	lb.	.04
Sodium Metallic	lb.	.90
Sodium Nitrate	lb.	.05
Sodium Phosphate	lb.	.09
Sodium Silicate (Water-Glass)	lb.	.04
Soot, Calcined	lb.	.15
Spelter, see Zinc.		
Sugar of Lead, see Lead Acetate.		
Sulphur (Brimstone) in lump	lb.	.05
Tin Chloride	lb.	.43
Tin, Metallic	lb.	.39¾
Turpentine, Venice	lb.	.35
Verdigris, see Copper Acetate.		
Water, Distilled	gal.	.15
Water-Glass, see Sodium Silicate.		
Wax, Beeswax, yellow	lb.	.45
Wax, Carnauba	lb.	.70
Whiting (Ground Chalk)	lb.	.02
Zinc Carbonate, dry	lb.	.19
Zinc Chloride	lb.	,12
Zinc, Sulphate	lb.	.06
Zinc, (spelter)	lb.	.05⅝

THE BRASS WORLD AND PLATERS' GUIDE

VOL. VII. BRIDGEPORT, CONN., FEBRUARY, 1911. No. 2.

A MONTHLY JOURNAL DEVOTED TO THE ART OF REFINING, ALLOYING, CASTING, ROLLING, FOUNDING AND ELECTRO-PLATING OF ALL THE NON-FERROUS METALS AND THEIR ALLOYS.

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Possibilities in the Use of Rare Metals in Alloys.

The results that have been obtained in steel by the use of nickel, tungsten, vanadium, molybdenum, titanium, chromium, and other so-called rare metals, serves to indicate that the possibilities are equally as great in the manufacture of the non-ferrous alloys. The field is, we believe, even larger and the possibilities greater than in the ferrous alloys.

Action is always followed by reaction, and the fact that it is now possible to obtain many of the so-called rare metals at a reasonable price, has already stimulated researches along the line of their use in the non-ferrous metals and alloys. This fact is well illustrated in recent uses of the rare metals. Zirconium is now proposed as a deoxidizing agent, and it is claimed to have superior qualities. Vanadium, it is stated, is useful in the manufacture of babbitt-metals, inasmuch as it produces clean scrap material when melted. Chromium has already been used in the manufacture of strong bronzes. Only a beginning has been made, however, and it is believed that the future will see remarkable products produced through the agency of these metals.

It is remarkable and also interesting to note the change in character of the so-called rare metals and their transition from the rare class to a common one. Titanium, chromium, tungsten, and some of the other metals have, in the past, been called rare for the reason that they were seldom reduced to metal. The ores, however, are more or less common, and through the agency of the electric furnace and the alumino-thermic process, their reduction

from the oxides is a simple matter, and it is now possible to obtain them in large quantities at a comparatively low price.

As an example of the possibilities of the rare metals, let the now well known pyrophoric or "sparking" alloys be cited. The reader is familiar with them in the form of self-lighting gas igniters, match boxes, etc. An alloy of iron and cerium possesses the property of emitting sparks when struck, and it is this alloy which is used. Before this fact was discovered, cerium was only a curiosity and no use for it was known.

Tantalum is also a metal unused until it was found that it could be drawn into wire and employed as electric light filaments. These facts are more than interesting because these metals can be obtained in quantities to meet the demand, and are not, like gold or platinum, rare elements in the true sense of the word. They have been called rare because seldom found in the metallic state.

Spelter Chills.

The cause and effect of spelter chills are so well known in the great brass manufacturing centers that comment upon the subject seems almost unnecessary; but small brass founders are often found who do not understand the subject and in addition, manufacturers who have a brass foundry frequently desire to know the actual symptoms and effect in order to ascertain whether employees really have this ailment or whether it may be another.

"Spelter-chills," or "Brass-founders' ague" as it is called in England, is the ailment produced by the inhalation of oxide of zinc, or "spelter fumes" as they are usually called. Those who work in such an atmosphere finally become immune, just as persons become immune from other diseases. A new brass caster or molder soon succumbs, but after a few chills rarely has any more.

The symptoms of the chills are as follows: When the subject has worked a few hours, he becomes cold and feels languid and depressed. He becomes pale and almost in a state of collapse. He shivers as though a malarial chill were upon him, his teeth chatter and his body becomes covered with cold perspiration. Muscular pains follow and finally a severe headache, is experienced, followed by severe nausea and vomiting. The symptoms are not unlike those of ordinary malaria and frequently one may be mistaken for the other. The chills are an invariable part of the poisoning by spelter fumes, and have resulted in a belief that they are analagous to those of malaria, and are apt to appear at certain intervals. This, however, is erroneous.

The treatment followed in cases of spelter chills is to put the patient to bed and administer some liquid that will serve to counteract the effect of the oxide of zinc in the stomach. Milk is the usual remedy for this purpose and is given freely. It is a singular thing that although the patient may have a severe attack of the chills in the afternoon, they soon pass off and he is able to return to work in the morning none the worse for it.

Silver Plated Flat-Ware to Stand Rough Treatment.

Two English investigators, Professors McWilliam and Barclay of the University of Sheffield, have carried out an extensive series of experiments to discover the reason for the peeling of the silver on silver plated flat-ware subject to rough treatment in restaurants, hotels and similar public places. Their article on the subject is printed elsewhere in this issue.

They believe that the cause of the peeling is not from any lack of care in the plating, but in the use of a German-silver base containing too much nickel. They state that it is their belief that the low grades of German-silver containing under 14% of nickel, are capable of giving better results than the ones containing more nickel. In other words, 18% German-silver flat-ware is more apt to peel than a 10% or 12% metal. The more nickel the German-silver contains the more apt the flat-ware is to peel while in use.

These results are somewhat astonishing and according to replies made to the paper when read before the Institute of Metals, it would seem that the theory is difficult to accept. It is difficult to believe that the difference of a few per cent of nickel would cause one lot of spoons or forks to strip in use, while another would not when treated the same.

We would welcome experiences from flat-ware manufacturers in this line, and will be pleased to publish any information that can be given us.

The "Ronay" Process of Briquetting Brass, Bronze and Other Metal Chips, Grindings, Filings, etc, Without Binding Material.

The briquetting of fine materials is an old process and has been in use for many years, but heretofore a binding material has always been necessary. In the smelting of fine copper bearing material, silver sweeps and iron ores it is necessary to make some sort of a briquette or lump of them, otherwise, when charged into a blast-furnace they would either be blown out or prevent the passage of the blast through the furnace. It has been customary to use lime for such a binding material. The fine material, such as, for example, fine brass skimmings, is mixed with the necessary quantity of slaked lime and then compressed by a briquetting press into the form of briquettes. These are allowed to dry and harden. Exposure to the air changes the lime to carbonate which renders the briquette hard and capable of standing rough usage. They can then be charged into a blast furnace without difficulty.

Fig. 1. Large Assortment of Briquettes Made by the "Ronay" Method. In This Assortment are Briquettes of White-Metal Chips, Copper Filings, Brass Filings, Steel Filings, Graphite, Aluminum Chips and Cement Copper.

In the briquetting of fine copper bearing

material, silver sweeps, ores, etc., the use of the lime is advantageous in two ways: First, it acts as a binder for the material. Second, it is necessary in the smelting as a flux. When other materials, such as, for example, brass or bronze chips, are to be briquetted, the use of lime is a direct injury as it prevents the successful melting of the chips in crucibles. These materials are melted and not smelted, and the use of a flux is not advisable.

There has recently appeared in Germany a process for making briquettes which has proved quite advantageous for many classes of materials, both metallic and non-metallic. It is the invention of Arpad Ronay and is called the "System Ronay." It is being introduced into the United States by G. Leve and plants for the briquetting of metal chips have already been installed in the Westinghouse Air Brake Co. at Wilmerding, Pa., and at the Baldwin Locomotive Works at Philadelphia, Pa. Three patents have been issued upon the process in the United States, and a large number in a number of other countries. The principal patent in the United States is No. 778,809, Jan. 3, 1905, upon the method of making the briquettes. Other patents (No.'s 749,326, Jan. 12, 1904 and 668,585, Feb. 19, 1901) are upon methods of making the briquettes with a binder and really have no bearing upon the present process.

The "Ronay" process of making briquettes from metal chips or other fine metallic material consists in subjecting the metal to an enormous hydraulic pressure so that every part is compressed and made so compact that a comparatively solid material is produced. In this connection it may be said that the noted investigator of Belgium, W. Spring, found, many years ago, that if fine filings of soft metals, such as tin, lead, silver, copper etc., were subjected to an enormous hydraulic pressure, a solid metal was produced. In other words, the metal particles became united again. If particles or filings of different metals were mixed intimately in the proportion of alloys and subjected to the pressure, solid masses of the alloys were produced. The "Ronay" process embodies this principle.

No binding material at all is employed and the use of the pressure brings about the desired compactness. While the method of making the briquettes is simply one of subjecting the metal to the necessary hydraulic pressure, something more is necessary than pressing the metal chips or other fine material in a mold. Were this done, the air between the particles of metal would be compressed and when the pressure is released, the air would expand again thus rupturing the briquette or causing it to become too weak. It is in this removal of the air that the process really depends and the method of doing it is explained by reference to Fig. 2 the illustrations of which are taken from the patent specification. The method of carrying out the formation of a briquette is described by the inventor in the following manner:

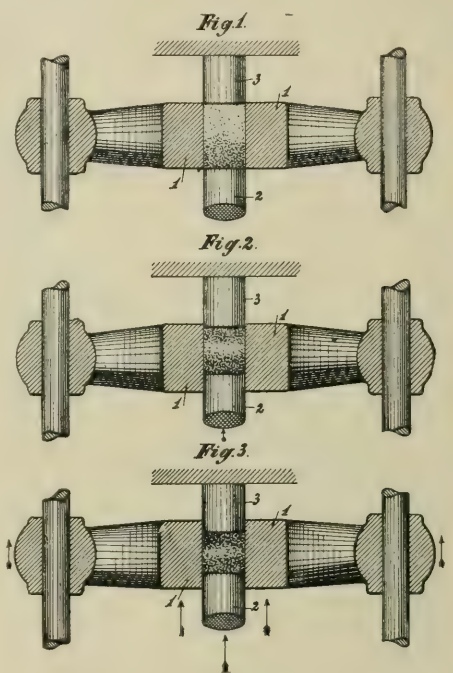


Fig. 2. Method of Making the Briquette.

"Fig. 1 is a diagram showing the pressing-mold filled and closed, respectively, by the upper pressing-stamp and the lower counter-stamp. - Fig. 2 shows the lower pressing-stamp pressing one side of the material; Fig. 3, the mold pushed onto the counter-stamp during the extreme final pressure and containing the block uniformly compressed and formed entirely free from air.

1 1 represent the mold sliding alone automatically or in some other way with the pressing-stamp 2 in guides, under which arrangement the mold actuated with the pressing-stamp 2 can be pushed at any desired stage of the pressing operation onto the counter-stamp

3, whereby precisely equal pressure can be applied to both sides of the block, and, on the other hand, the air can escape, almost without hindrance, from the material during the whole period of compression until the extreme final pressure is applied. The mold 1 can be urged forward over the counter-stamp 3 by means of any suitable mechanism (not shown) or may be urged forward simply by means of the pressure on the inner walls by the material which is being pressed forward by the pressing-stamp 2.

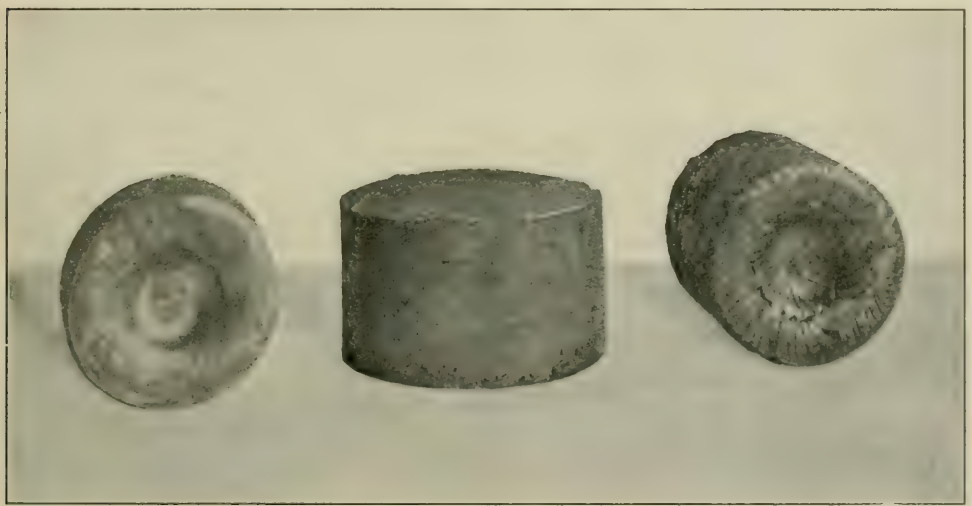
Considering that the greatest pressure applied is very rarely less than eight hundred atmospheres and generally about two thousand atmospheres, by means of this process a block can be produced which, practically speaking, is uniformly compact and firm throughout—that is, one which has no so-called "neutral-pressure" zone, provided, of course, that the quantity of material (height of the block) is duly regulated in accordance with the nature of such material.

The importance of the novel effect obtained by this process may be inferred from the fact that the block which has just left the press can be at once exposed to the greatest heat without any fear of its coming apart."

The pressure employed is necessarily enormous and from 12,000 to 30,000 lbs. per sq. in. are used. The pressure generally employed for metallic substances, it will be noticed, is about 30,000 lbs. per sq. in.

The application of the process is extensive. In Fig. 1 is shown a large number of materials which have been brightened by it. These were made in Germany, and as our illustration was obtained from there, the German names are on the briquettes. Some of the materials shown are: Brass chips, copper filings, graphite, salt, coal, iron ore, white metal chips, aluminum, cast-iron chips, cement copper etc.

In Fig. 3 are shown a briquette of babbitt-metal chips, one of bronze chips, and another of copper filings. The character of the briquettes may be seen. In Fig. 4 a pile of iron ore briquettes is shown. These are reproduced in order to illustrate how hard the briquettes are and how they will stand rough usage.



White-Metal. Bronze. Copper Turnings.

Fig. 3. Briquettes Made from Non-Ferrous Metals, Showing Character of the Mass.

The application of the process, as far as the non-ferrous metal trade is concerned, is exceedingly important. Every brass manufacturer and foundryman know that to melt chips or filings means a large waste. This is so excessive that brass rolling mills do not like to take back chips from their customers, although heavy brass is readily purchased. Owing to the waste in melting, the chips prove unprofitable. By the use of a briquetting machine, the chips can be made into a solid, compact mass that may be melted with the minimum amount of loss. It is well known that the waste in melting finely divided metals is caused by the excessive surface exposed to the air. A large amount of oxidation then

follows. By making the metal into the form of a briquette a practically solid piece of metal is obtained, all air is removed, and when melted the result is the same as in the melting of solid masses.

In the treatment of aluminum chips, the process is particularly important as this metal, more than any other commercial one, is difficult to treat in such form. When briquetted, the melting would become a simple operation and the resulting metal would be worth using. Metal now made from aluminum chips is of the poorest quality.

known as figures are not obtainable at the present time, but it should and undoubtedly will reduce it more than half. Take, for example, yellow brass chips which, when melted in establishments carrying on the best practice, cannot be treated in crucibles at an average loss of less than 5%, it is probable that the briquettes can be melted with half this loss at least.

It is believed that the briquetting of fine metals is an exceptionally important process, and that it has fully as much bearing on the non-ferrous trades as the briquetting of iron

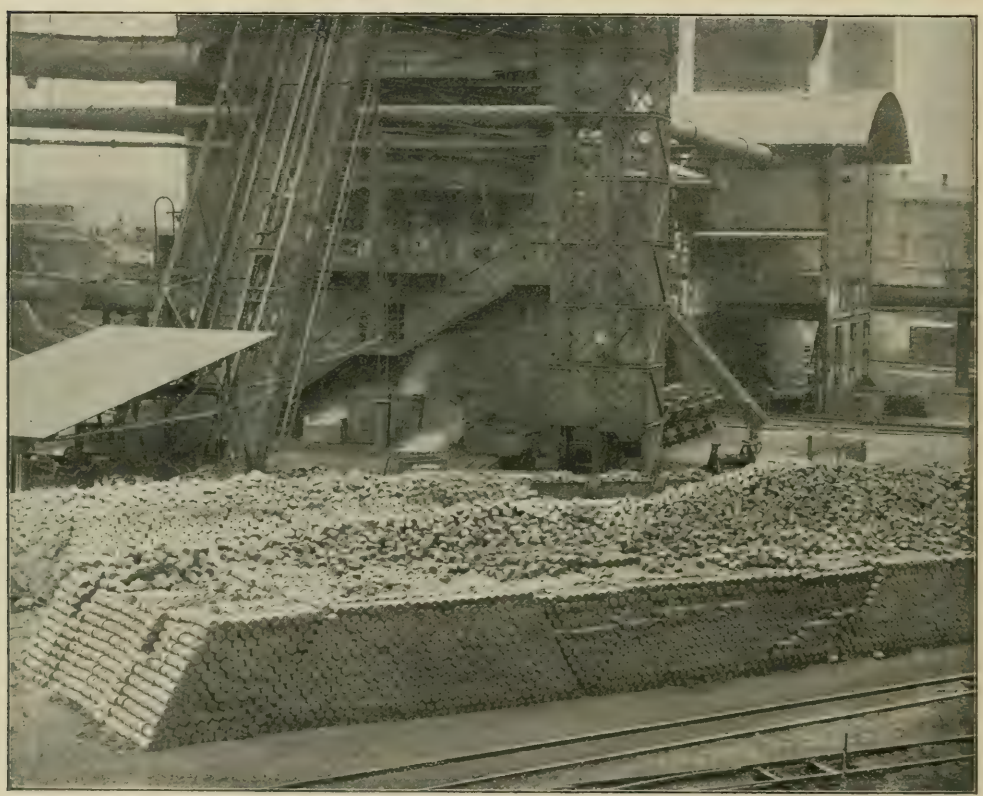


Fig. 4. Illustration of the Appearance of a Pile of the Briquettes. This Photograph Shows a Blast Furnace in Germany with Pile of Iron Ore Briquettes.

The capacity of the briquetting machine, when properly served and supplied with the raw material, is from 5 to 8 tons per hour. The cost (in Germany) will run from 25 to 30 cents per gross ton. The power required to run so large a hydraulic plant is necessarily large and it is stated that from 75 to 100 horse-power is consumed in one press.

What the waste is in melting brass or bronze chips, that have been briquetted, is not

or steel chips. Owing to the necessarily high cost of the equipment, however, it is not a process for use in small establishments, but in large ones that have a constant supply of chips, filings or other finely divided materials, it will prove a great reducer of costs. What to do with finely divided materials or how to treat them has always been a problem in the manufacture of brass and similar copper alloys or non-ferrous metals.

The Effect of Copper on Nickel Plating Solutions.

Copper is the most common impurity in nickel plating solutions as it is so easily introduced. Copper or brass hooks may be used for hanging the anodes in it, brass articles that are to be plated may fall down in the bottom of the tank and be allowed to remain there, copper stringing wires may also fall into it, and lastly anodes made from scrap are apt to contain more or less copper. All commercial nickel, too, contains small amounts of copper, but usually not enough to render it injurious when made into nickel anodes.

In order to ascertain just what effect copper has on a nickel plating solution, a number of experiments were carried out. In the first place, a standard nickel plating solution was made up from pure materials. The solution was made in the following proportions:

Water	1 gallon
Double Nickel Salts	8 oz.
Single Nickel Salts	1 oz.
Sal-Ammoniac	1 oz.
Boracic Acid	¼ oz.

This solution, it is believed, represents a standard nickel plating solution as now used. When made up it stood practically 6 degrees Beaumé.

The solution was used cold and a 90-92 percent nickel anode was employed. The first experiment was made without the addition of any copper in order to ascertain whether the solution was capable of producing a good nickel deposit. A current of 3 volts tension was employed at first and this produced a very white and even nickel deposit. At 2 volts, the deposit was even better. At 4 and 5 volts, it began to burn slightly on the edges. For a cathode a sheet of brass 3 x 6 inches was employed. The amount of solution used was 4 gallons. It was certain, therefore, that the nickel solution thus made up, was of good quality and capable of producing a white nickel deposit.

Experiment 1.

The first experiment was made by adding 1/16 oz. of sulphate of copper crystals to every gallon of the solution. The effect at 3 volts was not visible at once, but in a few minutes a decided darkening of the nickel deposit was noticed. In five minutes the deposit was sufficiently dark to be conspicuous. At 2 volts, the darkening took much longer, but after ten or fifteen minutes, it could be seen that the nickel was perceptibly darker than the original deposit. It was apparent, however, that with this weak current (2 volts) the effect of the copper was not as pronounced as when a higher voltage was used with its accompanying higher current density.

The effect of this amount of copper seemed to be that of a slight darkening of the nickel deposits. When buffed to a high color the nickel deposit would be called an ordinary deposit unless placed side by side with one containing no copper. Even then it was hard to distinguish, as polished surfaces are more difficult to compare in color than dead ones.

Experiment 2.

To the solution was now added an additional amount of 1/16 oz. of sulphate of copper bringing the total quantity up to ⅛ oz.

At the low voltage (2 volts) the deposit became dark in a few minutes so that it was quite perceptible. At 3 volts it darkened almost immediately. The color of the nickel thus deposited was darker than that of experiment 1. When buffed, its color was decidedly dark, so that it would be called a very poor nickel deposit.

Experiment 3.

An additional amount of ⅛ oz. of sulphate of copper was now added, making the total quantity ¼ oz.

The deposit in this solution was almost black at either a low or high current density and was not completely adherent. A smut formed on the surface that could be readily wiped off. The color of the nickel deposit was dark and when buffed had the color of a badly burned deposit. The nickel would be called unfit for use.

Experiment 4.

To the solution was now added enough sulphate of copper to make the total quantity 1 oz. When the deposition commenced, a black smut made its apearance at once. This could be easily wiped off. The actual color of the nickel deposit could not be ascertained as the smut prevented its true deposition, but it seemed to be about the color of the preceding deposit. The deposit was black, but non-adherent and of no value. A singular phenomenon was noticed in this experiment. The surface of the anode turned to a slight copper color. It was apparent that the nickel in the

anode (or the iron, perhaps) had precipitated the copper. This took place only when the current was not flowing and upon standing some time.

Summary of Results.

The results obtained indicate what has been supposed for a long time, viz: that copper darkens the nickel deposit. The effect of copper on nickel plating solutions, therefore, may be summed up as follows:

1. The presence of as small an amount of copper in the solution as 1/64 oz. to the gallon (equivalent to 1/16 oz. of sulphate of copper) is appreciable and darkens the nickel deposit slightly. This amount is about 1% of the amount of nickel present.

2. When the quantity of copper is increased, the nickel deposit becomes still darker, and a smut forms.

3. That if the whitest nickel deposit is desired, the solution should be free from copper.

Copper, therefore, may be assumed as an injurious ingredient in a nickel plating solution, as it has the tendency, even in small quantities, of turning the nickel deposit dark. It is a common impurity in nickel anodes and when a nickel deposit is not sufficiently white and the current and solution are right, the presence of copper should be suspected.

Use of Zirconium in Deoxidizing Alloys and Metals.

A patent has recently been issued to Ludwig Weiss of Barmen, Germany, (U. S. Patent 928,326, Jan. 24, 1911), in which the use of zirconium for deoxidizing and strengthening metals and alloys is claimed.

It is stated by the inventor that zirconium is far superior to titanium for this purpose. Among other things he says:

"For obtaining sound metal castings it has been recommended to use strongly deoxidizing elements, among others, titanium. It has, however, been found difficult to dissolve the same in metal baths and further considerable loss through waste is occasioned. Also, titanium possesses a relatively low combustion point, so that it does not extract the oxygen contained in the metal baths with sufficient energy. Further, the specific gravity of titanium is comparatively low, so that its suitability for forming alloys is decreased. Finally, alloys of titanium containing more than 2% to 3% of titanium are difficult to work in the hot state. Investigations have proved that all these disadvantages can be avoided by using zirconium or combinations of zirconium with other deoxidizing or inactive substances, for instance, zirconium-carbid, zirconium-silicid, ferric zirconium cupriferous zirconium, or with the further addition of nickel, molybdenum, chrome or wolfram.

The zirconium or the above-mentioned combinations and alloys can be added with the greatest ease to the molten metal, for instance, iron, gun metal, brass, copper, aluminum-bronze or the like, and are totally dissolved in them.

It is advisable to prepare alloys of zirconium with a high percentage of zirconium, for instance, with 10 to 35% zirconium, and then to add small quantities of this alloy to the molten metal. If it is only desired to obtain a sound casting, very small additions of zirconium, less than 1%, are sufficient; there are enough to greatly increase the tenacity and strength of the metal. Greater additions of zirconium to the above-mentioned metals and alloys will further increase the strength and toughness of the products, and will further render them more insensible to chemical agents.

Metals alloyed with zirconium, apart from the advantages already mentioned, have greater strength than those alloyed with titanium and are more proof against acids. Further, many of the alloys with zirconium possess great hardness and elasticity and are especially adapted for castings, and also for constructive or engineering work."

According to an analysis, "Magnolia Anti-Friction Metal" consists of the following: Lead, 78.27%; antimony, 17.81%; tin, 3.88%; and copper, 0.04%. The copper is an impurity. To make the metal the following are used: Lead 80 lbs.; antimony, 15 lbs.; and tin 5 lbs.

A very white and strong metal for use in making all kinds of goods that are cast in sand and upon which a white color is desired, is made by mixing 50 lbs. of copper, 35 lbs. of zinc and 15 lbs. of nickel. To this is added 2 oz. of aluminum. It cannot be cast in sand without the aluminum. It stands sea-water well and is extensively used for boat fittings.

Some Examples of Deep Etching and Metals Pierced by Etching.

Now that the etching of metals is becoming so extensively employed for certain classes of work, notably in the manufacture of name plates, signs and similar work, it will undoubtedly be of interest to the manufacturers of metal goods, and others who work in this line, to learn of the really artistic work that can be done by etching and to see the results of an expert in this line.

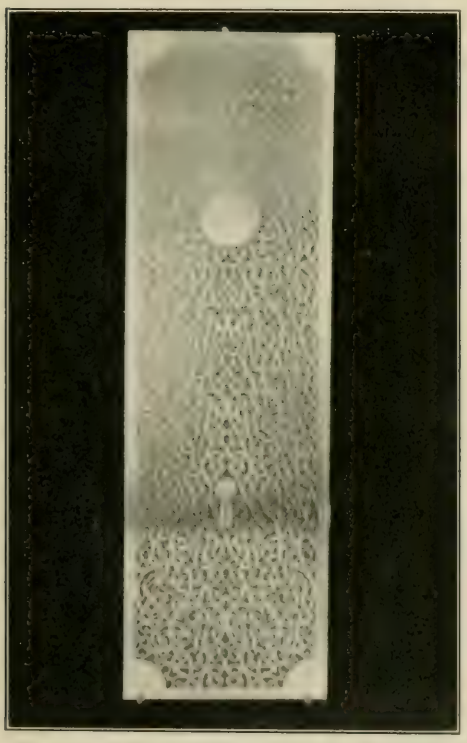


Fig. 1. Brass Escutcheon Deeply Etched.

The term etching is applied to any class of work in which a design is etched or eaten away by a chemical solution. It is always accomplished by the use of a "resist," which is a substance applied to the metal to prevent the action of the solution upon the portions that are not to be etched. Etched work ranges all the way from the commonest steel knife blade, upon which the name of the maker has been etched, up to the most intricate work pierced by etching as herewith illustrated.

The fine examples of etched metal herewith shown are the work of John R. Baynes, 115 Roosevelt St., Bridgeport, Conn., who has made a special study of fine and artistic etching as the samples herewith shown will indicate.

The skill in etching lies wholly in placing the design on the metal to be etched. There are many ways of doing it. First, by painting the design on with a suitable material to act as the resist. This was the first method used for etching, and is now employed to some extent. Owing to the fact that each design must be painted on the work separately, and by skilled labor, the cost is necessarily high.

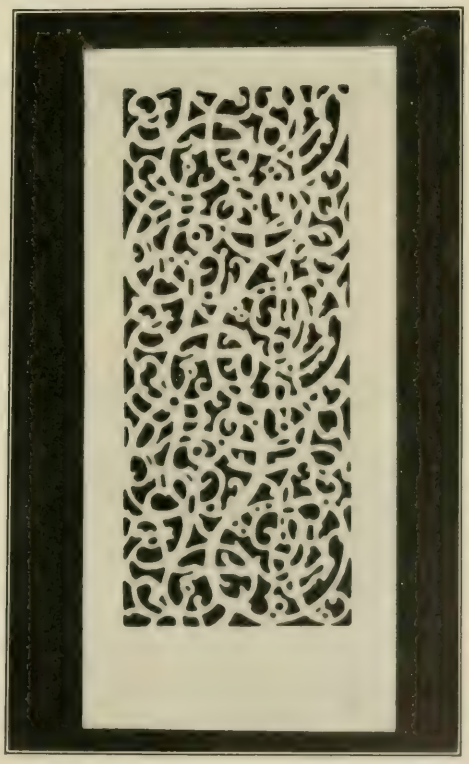


Fig. 2. Sterling Silver Plate Pierced by Etching.

It is suited, however, for articles of which one piece only is to be made. The second, or rubber stamp method, is employed only for the cheapest class of work. The design cannot be made sharp and the etched design is, therefore, rough. The process is the cheapest form of etching known and it is for this reason that it is employed in placing the

name on steel knife blades. Outside of this class of work, the rubber stamp method is not used. Then there is the transfer method which is suited for a slightly better class of

Fig. 3. Sterling Silver Plate Nearly Pierced by Etching. This is the Front of Fig. 4.

work than the rubber stamp process, but even with this, sharpness is somewhat lacking. The design is transferred from a steel master plate, by means of transfer paper, to the metal and then etched. The resist is the material transferred.

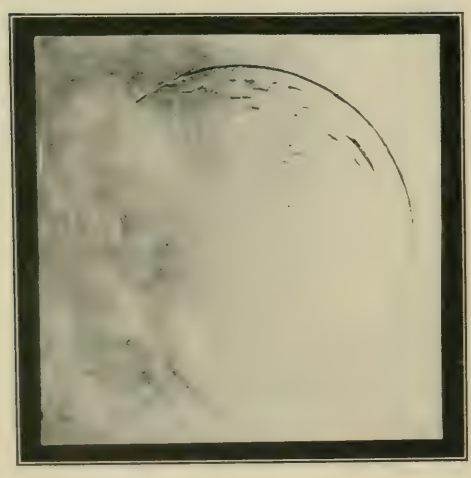


Fig. 4. Back of Sterling Silver Plate Shown in Fig. 3, and Indicating How the Etching Solution Begins to Cut Through.

Last and best is the photographic process by means of which the finest lines may be reproduced. It is the process by which nearly all the fine work is done. Name plates are made in this manner, and the work herewith illustrated was also made by it.

The photographic process of etching is carried out in the following manner: A design is first drawn on white paper of the exact kind that is to be reproduced. This design may be larger than the one that is to be etched if desired as it is readily reduced. This sketch must be in black in white, and the blacks must be solid and as heavy as possible in order to obtain a good negative from them. A photographic negative is next made of this sketch. This is easily obtained from photo-engravers who make a practice of doing it. Such a negative is preferably made by the wet plate process (collodion) and when completed, the blacks must be perfectly opaque and the whites of clear glass. If the blacks

Fig. 5. Sterling Silver Deeply Etched for Enameling.

are transparent so that the light passes through them, good results cannot be obtained. This feature, however, is readily obtained by those who understand negative making. The ordinary dry plate negative that might be called a good one will not answer as the blacks are not sufficiently opaque. This negative is used in printing the design on the article to be etched.

The method of printing the design on the metal by means of the negative, is carried out in the following manner: The metal is coated with a sensitized emulsion of bichromated albumen. This material has the property, when

exposed to the light, of becoming insoluble in water. Therefore, the portions that are not acted upon by the light are dissolved. The coated metal is exposed to either ordinary or electric light for a short time and then removed from the negative. A roller coated with a special lithographic ink is then rolled over the surface so as to coat the whole with ink. The plate is now placed in warm water and the parts not acted upon by the light are removed, leaving the bare metal. Those which

Fig. 6. Very Thin Copper Sheet Pierced by Etching.

have been acted upon by the light (corresponding to clear glass in the negative) remain on the metal and protect it as the etching resist.

The design is now on the metal in the form of a bichromated albumen base covered with ink of a sticky nature. In order to further reinforce it, the plate is dusted with dragon's blood and the whole warmed so as to melt it. The substance, of course, adheres only to the portions containing the resist. That which settles on the bare metal may be blown off. After cooling the metal plate, the design is on the plate in the form of a resist of a thickness that will not be attacked by the solution used for etching.

In connection with the resist it may be said that Mr. Baynes has used for a long time a resist of his own that seems to have an exceptionally strong power of resisting acids. The ordinary resist, as above described, is usually not of sufficient strength to stand deep etching. This is why ordinary name plates are not etched deeply. The resist is, of course, the most important part of the whole etching process.

When the resist has thus been obtained on the metal to be etched, it is ready for the etching. For brass and copper, a strong solution of perchloride of iron is generally used. This is employed for the reason that it does not attack the resist like strong acids. Its action, however, is quite slow. It is of interest to know that Mr. Baynes etched the samples herewith illustrated with nitric acid. The resist that he uses is of such acid resisting properties that it is possible to use a comparatively strong acid. In fact, he has etched 14 karat gold by the use of aqua-regia and this, more than any one thing, indicates the character of the resist.

Deep etching is always the most artistic and many applications can be made of it. In Fig. 1 an escutcheon of sheet brass is illustrated. This was etched half way through the sheet so that the design stands out conspicuously. This etching was carried out by the use of nitric acid.

The etching of sterling-silver is one of the important operations that can be done by this method, and a number of examples of this

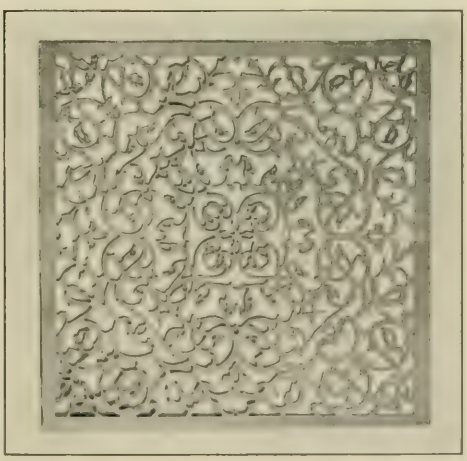


Fig. 7. Thin Brass Sheet Pierced by Etching. Suitable for Lamp Shades, Candelabra etc.

class of work are herewith shown, both in deep etching and in pierced work. In the etching of sterling-silver, it is necessary to use nitric acid as no other substance will attack it in the necessary manner. The nitric acid, too, must be comparatively strong in

order to dissolve it, and this, of course, necessitates the use of a very strong resist.

In Fig. 2 is shown a sheet of hard rolled sterling-silver that has been pierced clear through by etching. The sharp lines can be seen, even in the photograph. In Fig. 3 another example of sterling-silver etching is shown. This was carried out in order to indicate the manner in which the etching takes place. In Fig. 3 the front side of the plate is shown, while the back is illustrated in Fig. 4. The etching solution has just begun to cut through as may be noticed. This is the method which is followed in producing the pierced silver such as that illustrated in Fig. 2. In Fig. 5 another example of deep etching on sterling-silver is shown. This class of work is suitable for enameling and is readily accomplished.

the etching of metals. As the etching solution leaves the background too smooth to have the necessary contrast, it is customary to work it over with a pneumatic tool as shown in the photograph. This is an operation easily accomplished as the design is very readily followed and all that is required is to roughen the surface. It can be accomplished by unskilled labor. Mr. Baynes has done some extensive work in this line on marble monuments and which give the same results as expensive hand labor in cutting.

Rouge is the red oxide of iron. It is produced by calcining the sulphate of iron, and by the use of a strong heat, a hard rouge or crocus is produced. By the use of a lower heat a soft rouge is formed.

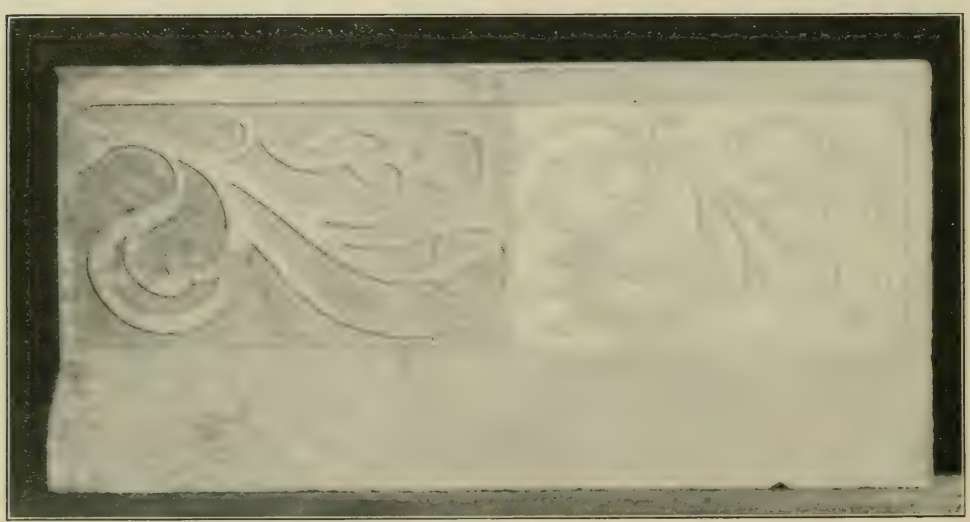


Fig. 8. Slab of Marble Etched and Half of the Background Chased by a Pneumatic Tool. Process is Cheaper than Hand Cutting.

The fine application of the process may be appreciated by referring to Fig. 6 in which an example of piercing on very thin sheet may be seen. This sheet is No. 30 gauge, hard-rolled copper and was pierced clear through by the etching solution. In Fig. 7 another thin sheet is also shown. Both of these effects can be produced on any metal and the application is in the production of artistic results for lamp shades etc.

One of the unique applications of the etching process is shown in Fig. 8. This is a slab of white marble and the design shown thereon was etched in the same manner as followed in

For ordinary stopping-off varnish for preventing the deposition of a metal during plating, asphalt varnish is excellent and cheap. It is easily removed by kerosene or benzine. It stands all solutions well except hot cyanide.

For cleaning long rails, tubes and other large work preparatory to plating and which are too large to enter the potash kettle, a fine slaked lime, rubbed on with a soft rag is excellent. The lime should be slaked and then allowed to dry . In this condition it can be kept for use. It removes the grease and is so fine that it does not scratch the metal.

Some Practical Experience with Corrosion of Metals.*

By Engineer Rear-Admiral John T. Corner, C. B. (Late Chief Engineer of Portsmouth Dockyard).

It should be pointed out at the outset that in this paper the writer purposes to limit himself to chiefly giving instances of corrosion which have come under his notice whilst actively engaged as a marine engineer, and to detail some of the practical methods found to be efficacious in dealing with the same.

Some of the causes of corrosion of metals on shipboard are so obscure, and the origin so difficult to trace, that no satisfactory explanation is so far forthcoming. On the other hand, cases have occurred in which the causes operating to produce the effects are clearly recognized and easily dealt with.

The writer has had no personal experience in the trouble which took place through the corrosion of copper and its alloys in the old wooden ships, but that such corrosion did exist is within the knowledge of most of those who have studied the record of such ships. Cases are mentioned of copper sheathing having become corroded in mysterious ways and at unexpected times, and there are reports of the heads of the nails having corroded entirely off, allowing the sheathing to become detached.

There were doubtless at times trouble through corrosion in the bilge and other copper pipes of the old wooden steamships of war, but as a rule these appear to have been of minor importance; and in many ships the chief anxiety the engineers had concerning the pipes was to keep them in a bright and burnished condition so as to pass the captain's weekly inspection at which the array of copper piping in the bilges was often one of the show sights of the ship.

With the introduction of iron for shipbuilding purposes the conditions were different, for it was soon found necessary to insulate as well as protect the copper pipes in or near the bilges—not, however, for their own welfare so much as for the sake of the adjacent plates and angles, which, when not so treated, were found to be adversely affected by contact, owing to the galvanic action set up between the metal pipes and the iron plating by the bilge water.

There were many instances in which very considerable trouble was caused. Among them may be mentioned the case of the troopship *Megaera,* which vessel had to be beached at St. Paul's Island about 1869 to prevent her sinking. It came out in the subsequent inquiry that among other defects in this ship, there was a serious one due to a copper strainer fitted to a bilge suction pipe in a remote part of the ship. The action set up by it was sufficient to eat right through the plates, and so admit water to such an extent that the ship had to be run ashore to save the crew.

As far as can be ascertained, the pipes themselves in iron ships were no more affected than those in wooden ships, probably not so much; and it was not until at or about the time of a great change in the internal economy of men-of-war that serious and persistent trouble through the corrosion of copper pipes began to be manifest and felt. This change was the introduction of the electric light on shipboard.

The writer's first experience of the insidious corrosion of copper pipes occurred in a ship which had recently been fitted with an electrical installation for working searchlights. During a commission of over three years, there were, as far as can be remembered, only two pipes which seriously suffered from corrosion; both were water pipes, and both were eaten right through in small holes which had the appearance of having been punched, and it is noteworthy that each of these pipes was in the immediate vicinity of an electric lead to a searchlight—the one forward and the other aft. The whole business was after all but a minor affair, and consequently very little notice was taken of it; it was only years afterwards when trying to assign a cause for similar trouble in various other ships that the previous experience was recalled to throw light on an obscure question.

There is no doubt whatever that the time of the introduction of the electric light in naval ships synchronized with a considerable increase in the corrosion of the copper and metal pipes and fittings; and as the parts affected were chiefly water fittings, the increased steam pressures which came at or near this period, and which might have been suspected as one of the causes, can be now quite absolved from any share or part of the trouble.

Sometimes pipes would be found eaten

*A paper read before the Institute of Metals at the meeting held in London, January 17-18, 1911.

nearly, and in some quite, through in a very short period; moreover, the replaced parts often became similarly affected even when different brands or qualities of copper or brass were used. Sometimes the pipes were eaten in holes having sharp, clean-cut edges, as though punched; sometimes parts were pitted and honeycombed over a considerable area of surface; while in other examples the metal was nibbled out in such a way as almost to suggest the presence of rodents or microbes.

As regards the source of this trouble, some engineers for the reasons above stated were inclined to attribute it to electrical action due to the leakage from the mains, which was often so great as to allow electricity to permeate the whole ship. It must be admitted now that some of the earlier electrical installations on shipboard were a long way from perfect, inasmuch as leakage in some cases was sufficient to turn the ships themselves into storage batteries. Others attributed these defects in the copper pipes to induced currents set up in different parts of the ship by the currents in the electrical mains. But nothing definite could be proved, and those dealing with the electrical plant disclaimed all responsibility for the trouble, and in fact sometimes expressing the opinion that the currents they used could hurt nothing and cause trouble to nobody.

It was also further suggested that the action might be due to mere chemical causes, but here again the responsibility for this was disclaimed by those concerned, the corrosion being put down by them to mechanical rather than by chemical action; and there was certainly some ground for the contention, seeing that corrosion in pipes generally occurred at or near bends or branches; also very extensive corrosion often occurred on the bronze propeller blades, especially at the forward side where there was little likelihood of extensive action, electrical or chemical, but abundance of the mechanical kind.

It is very probable that a certain amount of chemical action was first induced by galvanic action, and the erosion caused by the friction of the water, which washed away the results of the chemical action, left the clean surface exposed to further and similar action. This explanation, however, would not fully apply to cases where clean-cut holes were found in the pipes, condenser tubes, etc.; these results were probably due to want of homogeneity in the composition of the metal, the galvanic and chemical action finding out the weakest places. It would also appear that the presence of air and moisture together largely influences the extent of the corrosion of these metals as of iron, and in a measure helps to explain the pitting on the forward sides of the propeller blades, where the partial vacuum formed by the motion of the screws causes air to be drawn from the surrounding sea water, which assists the corrosive action.

It was also suggested that the corrosion might be due to the use of copper of too pure a quality; and in this connection it may be noted that some locomotive engineers specify for about ½ per cent. of arsenic in the copper fire-box plates, as a prevention against corrosion. So there really may have been something in this suggestion, seeing that pure electrolytic copper was beginning to be used at or about the time referred to.

But whatever may have been the causes, the pressing business of the day was to discover the cure of the complaint: the prevention of the corrosion, which affected most of the water pipes, including the condenser tubes of many ships, was what all aimed at. As regards the latter, it is understood that there was not much general corrosion of the tubes in iron condensers. No doubt there have been, as there still are, some instances in which the tubes of iron condensers have given considerable trouble through various causes, some of which were foul circulating water, defective materials, excessive vibration through indirect local pressure, such as the direct impinging of the steam or circulating water on the tubes, etc.; but as regards the corrosion under consideration, it may be stated generally that it is certainly much less in condensers with iron shells than in those with brass shells.

One special case of an iron condenser which came under the writer's notice was interesting and unique, and may be mentioned here:—A ship with a cast-iron condenser, with circulating water outside the tubes, had been running for several years with a set of tubes which had given no trouble whatever. The ship unfortunately got ashore on a sandbank, and in the getting off stirred up the sand so much as to get a large quantity deposited in the condenser on the circulating sides. On returning to port for overhaul and repairs, the tubes were taken out to get rid of the sand. This afforded the opportunity for examining and attending to the inside of the condenser shells. They were cleaned by being chipped and

scraped, and finally given a good coating of red-lead paint. Shortly after the ship resumed service, the condenser tubes which up to then had given no trouble, began to go to such an extent that the ship had to be again laid up for the complete re-tubing of the condensers When this was done, the red-lead paint was all removed, after which no further trouble with the tubes was experienced. This result clearly showed that the brass tubes were being protected when the iron shells were bare, but when covered with lead paint a corrosive action on the tubes manifested itself.

Another case of the protection afforded by iron may be mentioned:—In a certain ship, one particular pipe conveying circulating water was repeatedly in trouble through corrosion. This pipe would be found badly eaten away at a bend. It was taken down, patched, and replaced time after time, but the corrosion still went on and continued. The chief engineer then resorted to the following expedient. He sweated a lump of copper on the outside of the pipe, so as to provide material for a screwed hole, through which a large iron bolt, about 1½ inch diameter, was fitted so that the point protruded; and no further trouble was experienced with this pipe, the bolt being screwed further in as the point became eaten away, and being entirely renewed when necessary.

These two examples appear to indicate that the presence of sufficient bare or unprotected iron in perfect metallic contact with the system strongly counteracts the corrosion of the copper or brass; the chemical or electrical or mechanical action, whichever it may be, solely or jointly, being entirely expended on the iron. It is therefore by the free use of iron or steel that it is considered the best protection of the copper or alloy pipes is provided.

Before resorting, however, to such free use of iron, various other means were tried in different ships. One method was to coat the insides of the pipes with marine glue, another to use plumber's solder or tinman's solder as an internal coating. Special alloys containing aluminum were tried. Zinc slabs and blocks were used, as also zinc bars let in amongst the condenser tubes; and though some of these expedients effected a certain amount of good, it is considered that the present practice has more to recommend it than any of them, and that is the insertion of short iron lengths of pipe in runs of water pipes which can be easily removed and replaced; and further, the use of iron or steel doors for brass condensers with iron rods and plates in and about the tubes is very effective as a protection to the tubes and plates.

In some warships of late years the condenser barrels are made of steel. Of course in this latter case there is the possibility of a certain amount of corrosion in the condensers themselves, but as this is only to be expected on the waterside, it should not be difficult to deal with—the design of the condenser being such as to admit of the easy replacement of parts likely to be affected, and provision being made for zinc protectors as in boilers.

It is considered more than probable that the reason why iron is found on the whole to be more efficient as a protective than zinc, is that with the former better metallic contact is assured and maintained, and perfect metallic contact is undoubtedly an absolute necessity.

Respecting the corrosion on propeller blades, it is not known to the writer whether iron has been tried as a protection against corrosion; but he would suggest for consideration that if easily renewable plugs of iron could be put at the parts of the propeller blades where corrosion is likely to occur, they might lead to a marked difference in the extent of the pitting, for it may possibly be found that so long as there is iron in the immediate vicinity sufficient to absorb the corrosive action, the bronze will be entirely protected.

The presence of bismuth in brass is one of the causes of its fire cracking when annealed, but more is required to produce the cracking than is ever found in the copper from which commercial brass is made. While a possible cause of fire cracking, it is one of the least frequent.

An alloy of 92% copper and 8% aluminum (the so-called "8% aluminum-bronze") is practically the maximum mixture than can be successfully rolled into sheet or drawn into wire. When the aluminum is above 8%, the bronze becomes too hard to work. As high as 10% aluminum has been rolled into sheet, but it cannot be called a commercial process on account of the cost. All percentages of aluminum, however, may be rolled hot and the bronzes are quite soft when in this condition.

Production of a Brown Color on Brass.

By Charles Werft.

The following process of producing a brown color on brass will be found satisfactory. I have used it for some time for finishing chandeliers, showers, and ceiling lights. Any shade from an iridescent color to statuary bronze may be obtained by repeated dipping.

Solution 1.

Water	1 gallon
Liver of Sulphur	2 oz.
Caustic Potash	2 oz.

This solution is used hot as it works better than when cold.

Solution 2.

Water	1 gallon
Sulphate of Copper	3 oz.
Sal-Ammoniac	8 oz.

This solution is used cold.

The brass to be treated is first colored up on the buff wheel and the buffing dirt is then removed by washing in a potash solution. The article is then immersed in Solution 1, after which it is immersed in Solution 2 *without rinsing*. The article is now rinsed off in cold water. The process is then repeated until the desired color is obtained.

For statuary bronze it is much more rapid than copper plating and then coloring in liver of sulphur as the coppering is rendered unnecessary. If the work is handled so that there are no finger marks on the surface, a very pretty smut will appear which, so to speak, has the appearance of velvet.

I then take the article, brush with a platers' brush and lacquer with a flat lacquer. If it is sand-blasted or dipped, the surface will come mottled and darker.

When sulphuric acid is left exposed to the air, it absorbs water and becomes weaker. It should always be kept in a tight carboy.

A metal called "Sterline" was at one time sold in the shape of match-boxes, rings, pins and other articles of jewelry. It was simply a German-silver and an analysis showed it to contain the following: Copper, 68.52%; nickel, 17.88%; zinc, 12.84%; iron, 0.76%. The presence of the iron in the metal causes its exceptional whiteness. It has been known for some time that iron whitens German-silver.

Tricks in the Scrap Metal Trade.

Second Paper.

Mixing Red Grindings with Composition Chips.

Many brass founders are accustomed to purchase composition chips for a portion of their raw material from which composition castings are to be made. These chips are always a preferred material and command a comparatively high price. Red grindings, on the other hand, are always sold on "copper contents" and are a low priced material. There is a temptation, therefore among unprincipled scrap metal dealers to mix the two, as they well know that the composition is not injured in any way and that the resulting metal obtained by melting the mixture will be good composition. The purchaser, however, will find that his chips will waste excessively on account of the grindings they contain. He is being deceived, therefore, as he has paid for composition chips and has obtained part red grindings—a very much cheaper material. Red grindings, of course, result from the grinding of composition castings on an emery wheel and contain a considerable amount of emery and molding sand from the foundry. This emery and sand are paid for by the purchaser at the price of the chips.

If composition chips and red grindings are mixed in the ordinary manner, the two will separate when shipped on account of the difference in size. In order to prevent this, it is customary to coat the chips over with *molasses* and then mix them with the grindings. In this manner the two will adhere and will not separate in shipping.

In using the molasses in this manner it is possible to mix from 5 to 10 per-cent (or even more) of red grindings with the chips without being conspicuous, and unless the purchaser is forewarned he will not usually detect it. As there is a difference of two or three cents a pound between the chips and the red grindings, it is an object for the unscrupulous dealer to practice this deception.

Rag buffings, produced in the buffing of brass, will run from 5 to 8 per-cent in copper. When burnt the copper content is doubled so it will run from 10 to 15 per-cent. As a usual rule, burnt buffings of this kind will run about 15 per-cent in copper.

The Adhesion of Electro-Deposited Silver in Relation to the Nature of the German-Silver Basis Metal.*

By Andrew McWilliam and W. R. Barclay.†

A few years ago the authors had their attention specially drawn to a rather serious trouble in connection with the behaviour of high-quality electro-plated spoons and forks under

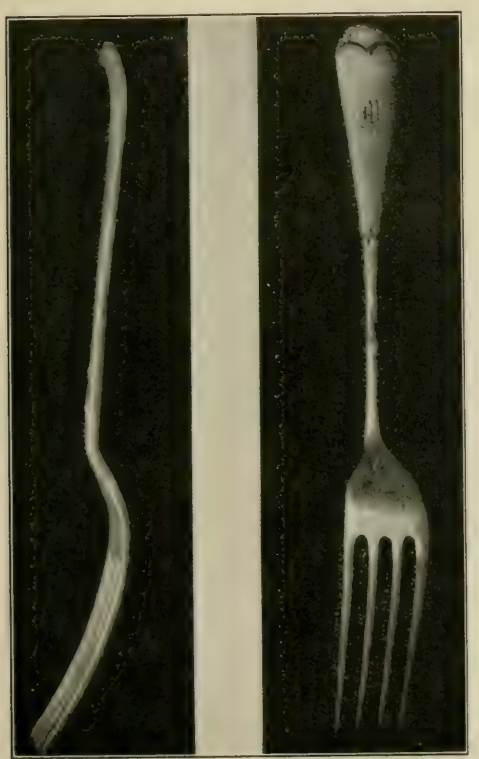


Fig 1. The Forks Showing Manner in Which Stripping Took Place.

very severe conditions of wear. It is well known that at the present day, a much larger proportion of such goods made are used in hotels, in steamboats, and by caterers than formerly. Owing chiefly to the necessities of the case, but partly to the destructive instincts of virile humanity, these goods are subject to very much severer trials than they would have undergone had they found their way into use in the service of private families, for in hotels, spoons and forks may have to be gathered up into large baskets and thrown into the receptacle in which they are to be washed, a kind of treatment that must be remembered in considering what follows.

A large quantity of spoons and forks, manufactured presumably under the best commercial conditions, examined and passed by experienced observers before being sent out from the factory, and apparently only differing from ordinary products in having an exceptionally heavy deposit of silver, were, after actual usage for 18 months or so, returned to the makers with the complaint that the deposited silver coating was "peeling" or "stripping" along the edges and from parts of the surfaces of the articles. In Fig. 1 is shown the manner in which it occurs.

As the trouble was not confined to a few isolated pieces but extended to the majority of the articles in a consignment, and was also in time found to occur in connection with goods from different firms, it was felt that the matter warranted a thorough investigation, particularly as no specific fault could be traced in any of the processes through which these goods had passed, where the details of the processes could be known. A full inquiry into the causes of this fault was made by request, and since the first part of the investigation was finished, quite a number of similar cases have been brought to the notice of the authors from independent sources and by personal observation.

In order to correct a misapprehension which might arise, it may be necessary to point out that no attempt is here made to discuss the ordinary causes of the "stripping" or "peeling" or "blistering" (as it is sometimes called) of electro-deposited silver from the basis metal during processes of manufacture, such, for instance, as that due to inefficient cleaning from grease or from oxide, careless treatment in scratch-brushing, or in the general preparatory stages of treatment, unsuitable plating liquid, &c., because articles so treated rarely pass from the hands of reputable manufacturers, the faults being revealed during the subsequent finishing and burnishing processes, it

*A paper presented to the Institute of Metals of Great Britain, at the January, 1911 Meeting.

†Assistant Professor of Metallurgy in the University of Sheffield, England, and Lecturer in Electro-Metallurgy in the University of Sheffield.

being well known that if the slightest trace of grease or oxide remain on the surface of the basis metal, the electro-deposited silver will blister under the pressure of the steel burnishing tools used in finishing.

The investigations were conducted from an entirely different point of view, the authors being convinced that the stripping of silver from articles which had passed all the ordinary tests of the manufacturer, and had indeed been in the hands of the users for periods varying from six months to two years, could hardly be ascribed to any of the ordinary causes mentioned.

From general experience, and from the examination of many plated articles that had been a generation in wear, the authors had formed the opinion that the adhesion had something to do with the nature of the basis metal, hence the investigations described in the present paper were undertaken with the view of determining not only the nature of the adhesion of electro-deposited silver to the alloys known commercially as German-silver or nickel silver as a basis metal, but also to find out what difference, if any, exists between the various grades of German-silver in general use in the trade, as to their suitability to form a basis metal for heavily electro-plated articles which are liable to receive rough usage.

Samples Tested.

The earlier experiments were made on a number of spoons and forks of various sizes supplied by manufacturers, and of the grades known in trade circles as Firsts, Seconds, Thirds, and Fifths. Analyses of these were not made, but the makers reported them as having approximately the following compositions as to nickel: Firsts, 20%; Seconds, 16%; Thirds, 12%; and Fifths, 7%. The content of copper appeared to vary between 56% and 59%, according to the few assays made. In addition to these spoons and forks, several test strips were obtained of each grade described, and of a similar character to spoon and fork blanks. All of the pieces were treated so far as possible in exactly the same manner, and cleaned, prepared, and electroplated, according to the best methods in general use, with the one exception that a few of the samples were given a preliminary coating of copper before silver plating. The electroplating was done by experienced workers, under the ordinary conditions of works practice.

Those which will now be described have been made under the personal supervision of the authors during the last twelve months, as, in order further to test the matter, in view of the possible publication of results, they determined to prepare a series of nickel silver alloys corresponding approximately to those in ordinary use amongst electro-plate manufacturers.

The following table gives the compositions of the alloys accordingly made:—

Table 1.

Mark	% Nickel	%Copper	%Zinc
A	20	57	23
B	18	57	25
C	16	57	27
D	14	57	29
E	12	57	31
F	10	57	33
G	8	57	35
BZ	18	50	32
BC	18	64	18

The choice of the above alloys is largely empirical, but they are fairly representative of the usual grades of copper-zinc-nickel alloys in commercial use. An endeavor has been made to systematise the series by fixing the proportion of copper on the uniform basis of 57 per cent. throughout, with the exception of the last two members, BZ, in which 7 per cent. of the copper is replaced by zinc, and BC, in which 7 per cent. of zinc is replaced by copper.

Each alloy has been made under the ordinary conditions of works practice, manganese being used as a dexoidising agent. The metal was cast into ingots of about 18 lbs. weight. These were rolled into sheets of a thickness and width suitable for spoon and fork blanks, and cut up into strips each 8 in. long and varying from ½ to 1 in. in width. In every respect these strips correspond to spoons and forks with the exception that they have not undergone the process of stamping.

The electroplating solution used was the usual standard one of the double cyanide of silver and potassium, and the weight of the silver deposited on each strip was at least equal to that given to the highest qualities of spoons and forks. In the following table is the weight of the silver deposit on the strips of each alloy, calculated per square inch of the surface:

Mark	*Deposit per sq. in. in Oz. Troy.*
A	0.0196
B	0.0160
C	0.0215
D	0.0210
E	0.0170
F	0.0240
G	0.0240
BZ	0.0198

The slight variation in the weight of the deposit is explained by the fact that it was considered advisable to give each strip a minimum deposit at least of the quality indicated above, without in any way interrupting the

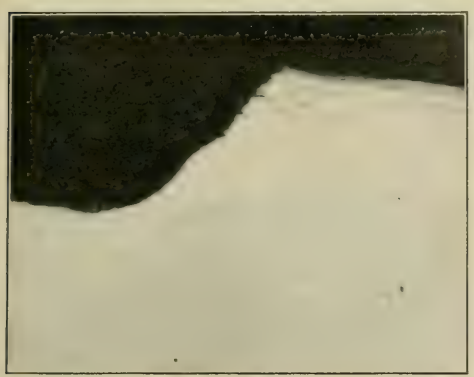


Fig. 2. Photomicrograph of First-Grade German-Silver Test Piece, Coppered and Silver Plated, Magnified 140 Diameters.

course of deposition, such as by taking the specimens out of the vat for intermediate scratch-brushing, a practice often followed in the making of very heavy deposits in order to keep the coating as smooth as possible.

The strips were consequently in the vat during the greater part of the working day, and naturally the rate of deposition varied as more or less work passed through the vat in the course of the day's operations.

Tests Applied.

The guiding principle in designing tests for the purposes of the investigation was to subject the samples to strains such as the basis metal and its silver coating would be given, if possible, a certain amount of movement relative to one another, and in addition that the coating itself should be fractured. In all the cases of stripping of which mention has been made in the introduction, the stages of development of the fault have appeared to be, first, that along the edges of the spoons or forks concerned the silver deposit has in course of severe wear become broken or cut through, then these broken edges have gradually curled or peeled up (see Fig. 1.), and if the deposited silver is thick, and therefore of sufficient substance, it may readily be pulled away from the basis metal surfaces. In some cases it has been possible by care and patience to peel the silver coating away from a fork almost from one end to the other.

With these points in view several preliminary tests were made with the apparatus available, and finally it was decided to adopt the test which had first appealed to the authors, namely, a simple cold bending test. One part of the sample is gripped in a vise and the free part is bent to and fro until it breaks off. It is advisable that the angle of the bend should be about a right angle, in order to ensure that the deposit and the basis metal get sufficient movement relative to one another. It will be evident that this test is an extremely severe one, and that unless the metals are holding together almost as one, the silver must be parted from its base, for the silver on the outside of the bend must move a greater distance than the basis metal, and on the inside of the return bend a less distance.

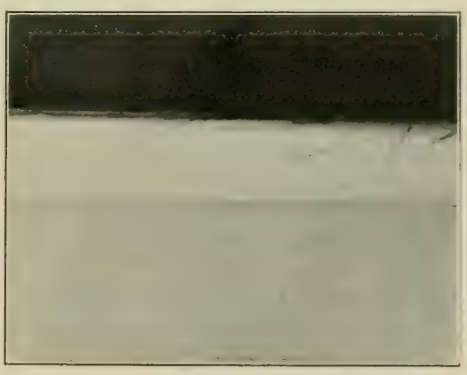


Fig. 3. Photomicrograph of First-Grade German-Silver Test Piece, Silver Plated. Magnified 140 Diameters.

In view of the results it should be noted also that the order of increasing ductility of the metals being as a rule from the high percentage nickel alloys to the low ones, the latter bearing more bending before fracture than the former, the test is more severe for metals of the G. F. and E types than for A and B. In practically every case the samples were tested to destruction.

Results of the Tests.

In the case of all the samples of Third (12% nickel) and Fifth (7% nickel) grades, and of the G (8% nickel), F (10% nickel) and E (12% nickel) specimens of the special alloys, it has been exceedingly difficult to peel up the silver coating in any way. In some few cases just at the point of fracture, it has been possible to raise the silver coating very slightly at the top, but in endeavoring to strip it further the silver, though very tenacious and ductile, has broken rather than leave its base. It has indeed repeatedly surprised the authors to find how extremely adherent the coating is under the severest tests. Test pieces of first and second grades and of A and B of Table I however, behaved in a very different manner. In practically every instance the silver coating left the base at the point of fracture, and in the majority of instances it could be pulled away quite readily from a considerable part of the surface without breaking the silver.

In the cases C and D, evidence of imperfect adhesion was not so pronounced as in A and B, still the authors do not regard these as so good as E, F and G.

In the earlier experiments described, a few samples of the first and second grades were given a rather different treatment; they were prepared for plating in the ordinary manner, but before silver was deposited on them, they were given a thin coating of copper from an alkaline copper solution, then transferred to the silver vat, and given a heavy deposit of silver. These samples were then put through the same tests as the previous ones, and again there was obtained evidence of imperfect adhesion, though not quite to the same extent as formerly. The adhesion even in these cases was not to be compared, however, with the lower percentage nickel alloys G, F, and E.

The electro-deposited silver in all the cases was tough and strong.

A considerable number of test-pieces after plating and before being submitted to the bending tests were burnished by experienced silver finishers. This process is considered in the trade to be, in addition to a help in finishing, a reliable means of testing the adhesion of the silver. The operation is usually done by clamping the article firmly on a bench and then passing a smooth dry steel burnishing tool over the entire surface and particularly on the edges. Unless the silver is in closest contact with its base at every point, the deposit will not pass this test without blistering. Every one of the test-pieces, spoons, forks, and blank strips, used in the investigation emerged successfully from this test.

Small divergencies in results were noticed between test-pieces made from nickel silver that had been deoxidised and those made from alloy that had not been deoxidised, the former giving better results than the latter for the same grades of alloys, but the number of the latter used were so few that attention is only drawn tentatively to the result, as the authors intend to make further comparative tests in the future.

Results of Microscopical Examinations.

Samples of every type were carefully examined under the microscope at about 40 and 400 diameters, and in special cases at 1000 diameters. It was found that in every case, when not submitted to strain, the silver deposit appeared closely adherent, and the microscope

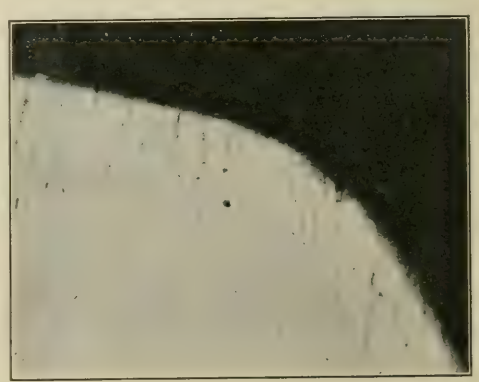


Fig. 4. Photomicrograph of Dessert Fork of Third Grade German-Silver with Thick Deposit. Magnified 140 Diameters.

did not reveal any marked difference between the nature of the junctions of the deposits with the various alloys. Those pieces from which the silver had lifted after being subjected to severe strain showed that the whole of the silver deposit had left the basis metal, but in the case of the samples of firsts metal coppered before silver plating, part of the copper had remained adhering to the silver and partly to the alloy.

The photomicrograph shown in Fig. 2 represents a transverse section of first-grade German-silver coppered before silver plating. The photograph includes a portion of the place where the mark had been struck, and

shows the consequent movement of the two metals. This deposit of copper between the nickel silver and the silver, is clearly discernible as a dark, narrow band. This piece shows the three metals in closest contact throughout.

Fig. 3 shows, in transverse section, silver deposited on first grade metal direct. In one place there is a slight indication of parting, evidently caused by the comparatively rough treatment of sawing and filing given during the preparation of microsections.

Fig. 4 shows part of a transverse section of a third-grade dessert fork with a heavy deposit of silver. In this specimen, even at the highest powers, the two metals seemed to be in closest contact. The line of demarkation shown in the photograph is caused by the difference in color between the metal and the alloy.

Conclusions.

The investigations clearly indicate considerable differences in the adhesion of deposited silver to the various grades of German silver alloys, even when all are treated under the same conditions of practice, and the authors are of opinion that this fact should have full consideration in choosing a basis metal for articles to receive the thickest silver deposits given, which will also be required to bear rough usage. They are not prepared to state dogmatically that any one particular alloy is best for this purpose, but they consider they have fully proved that ordinary commercial alloys of copper, zinc and nickel containing more than 14 per cent. of nickel are of doubtful utility in this respect. On the other hand, alloys of the types G, F, and E used for carrying heavy silver coatings electro-deposited with due care, will endure exceptionally rough usage without giving any cause of complaint on the ground of the silver stripping. It should be noted that the tendency to strip increases with the thickness of the silver deposit. The properties considered in deciding upon the grade of German silver to be used as a basis metal for electro-plating are strength colour, and malleability. As a general rule, passing from G to A in the series of alloys the strength increases, the colour approaches more nearly the white of silver, and the malleability decreases. With regard to whiteness, however, where thick coatings of silver are concerned this should not be considered as a matter of such primary importance as the perfect adhesion of the silver under the conditions of wear. Strength is more important than colour, and the lower members of the series are deficient in strength; but articles having quite sufficient strength and stiffness can be made of the type of alloy recommended by suitable mechanical and heat treatment.

Smelting Tin Dross in the Electric Furnace.

In THE BRASS WORLD, March 1910, page 96, was described an electric furnace for smelting tin dross. This furnace is the invention of Raymond S. Wile of the Riverside Metal Refining Co., Connellsville, Pa., and to whom a patent has been granted. The furnace is now in successful operation at the plant of this

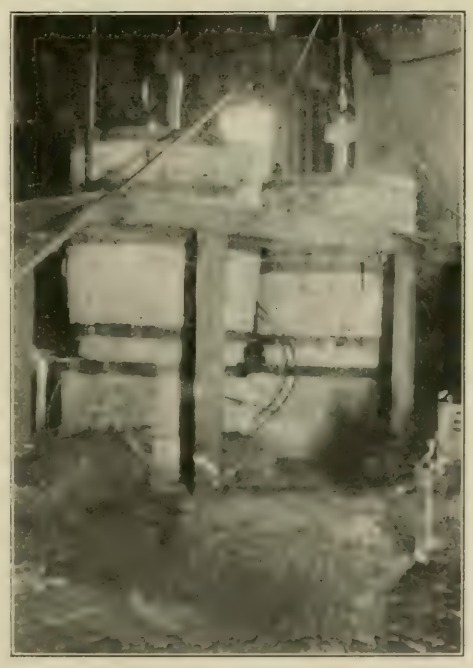


Fig. 1. Electric Furnaces Used for Smelting Tin-Dross at the Works of the Riverside Metal Refining Co. at Connellsville, Pa.

company, and is used for smelting tin drosses and slags. It has proved quite satisfactory for this purpose, and the smelting of these refractory materials has been simplified.

The two furnaces now in operation at the works are herewith shown in Fig. 1. In Fig. 2 a cross section of a furnace is shown to illustrate the principle. It will be noticed that the furnace is built cylindrical and the fire brick is held in place by steel hoops. The

interior may be well understood by reference to Fig. 2. Two carbon electrodes 6 and 7 are used for conveying the current. The top electrode 7 is made adjustable so that it may be accommodated to varying charges and conditions.

In operation, the two carbons are allowed to come in contact with one another and then raised until an arc is formed. The tin dross is then fed in. It is previously mixed with the right percentage of coke dust or coal

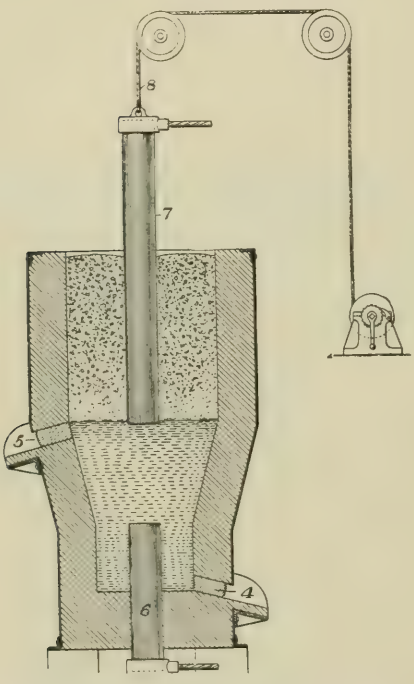


Fig. 2. Cross-Section of the Electric Furnace.

for its reduction. The tin is reduced and settles to the bottom where it is tapped off from the tap-hole 4. The slag is tapped from the spout 5.

The furnaces are each about 20 in. in diameter and 80 inches high inside. The two furnaces consume about 44 kilowatts. At the start the voltage of the current is about 80, but towards the end, when the slag becomes less refractory, the voltage drops to 50 or less. This and an analysis of the slag denote the end of the operation.

The furnaces are run continuously until they need relining which is about every three or four months. The average production of the two furnaces is about 2500 lbs. per day. The loss of tin has been kept as low as 0.25% and the regular average is below 1 per cent.

New Books.

PRACTICAL ALLOYING, By J. F. Buchanan. *The Penton Publishing Co., Cleveland, Ohio.* 305 pages, 6 x 9 inches. 41 illustrations. Cloth. Price, $2.50 post-paid.

The author of this book has already contributed "Brass Founders' Alloys" to the foundry trade and which contains much valuable information. In "Practical Alloying" the subject of metal mixing has been taken up in a thorough and painstaking manner. The book is written in a way that will at once appeal to the practical man and is free from confusing terms. The author is a practical man himself. The method of alloying all kinds of metals from ordinary brass to the soft metals is given with the mixtures and necesary information for the making of good castings.

SCIENTIFIC AMERICAN CYCLOPEDIA OF FORMULAS, By Albert A. Hopkins. *Munn & Co., Inc. 361 Broadway, New York City.* 1077 pages. Cloth. 6 x 9 inches. Price $5.00, post-paid. This book is a very extensive compilation of useful information and arranged in such a manner as to be readily accessible. Each article is its own index. The book is one of reference and will be found valuable for all engaged in the metal trades as it contains a vast amount of information upon these subjects. Matter of interest to metal workers will be found under the following heads: Accidents and Emergencies, Alloys and Amalgams, Art and Artists Materials, Cements, Glues and Pastes, Electrometallurgy and Metal Coating, Heat Treatment of Metals, Solders, Rubber, Gutta-Percha and Celluloid, Photography, Glass, Chemical Products, Weights and Measures etc., etc. The book will be of constant assistance to those engaged in the working of metals.

ARTS AND CRAFTS LAMPS and How to Make Them. By John D. Adams. *Popular Mechanics Co., Chicago, Ill.* Price, 25 cents. 5 x 7, bound in cloth. 87 pages. Illustrated. An excellent little book on the art of making lamps by the arts and crafts meth-

od. By following the instructions it is possible to produce articles of a unique and artistic nature.

HEAT. By J. Gordon Ogden. *Popular Mechanics Co., Chicago, Ill.* Price 25 cents. 5 x 7 bound in cloth. 119 pages. A useful and instructive book on heat, how it is measured, its nature and its production. Low temperature and how it is produced with the effect of low temperature on matter, is described in a full chapter. Another is devoted to high temperature and the rare metals.

New Resistance Alloys.

Some new alloys for electrical resistance work have been patented by Wilbur B. Driver of Newark, N. J. (U. S. Patent 981,542, Jan. 10, 1911). These alloys are composed of copper, nickel and manganese and they differ from alloys of a similar nature used for resistance work in that they contain larger amounts of nickel and manganese. The inventor states that there must be over 10% of nickel and 10% of manganese in the alloys to obtain the necessary resistance. To indicate the qualities of the various alloys, the inventor gives in the following tables the relative proportions of the copper, nickel and manganese, and the specific resistance of each alloy:

% Copper	% Manganese	% Nickel	Specific Resistance
60	10	30	65
45	10	45	68
75	15	10	53
65	15	20	61
70	20	10	68
60	20	20	75
50	20	30	88
40	20	40	98
65	25	10	85
60	25	15	93
55	25	20	95
55	30	15	113
50	30	20	123
50	35	15	124
40	40	20	150

It has been discovered that the use of nickel in the copper and manganese alloys serves to "fix" the electrical properties so that they remain constant. The inventor says: "When to copper is added a large percentage (10% or over) of manganese, and a large percentage of nickel (10% or over) there is obtained a homogeneous alloy that is ductile and workable. One that does not rust, and above all that has a specific resistance and is reliable and constant in its electrical behaviour."

He also compares the properties of some well known alloys used for resistance work and which will not rust:

Alloy	*Specific Resistance*
18% German-silver	18
Manganin	24
30% German-silver	28
Constantan	28

As the least resistance of any of the alloys given in the first table is 53, the large increase is at once apparent.

A Vanadium Babbitt Metal.

A new babbitt-metal mixture containing vanadium has recently been patented by Jesse L. Jones of the Westinghouse Electric & Mfg Co., of Pittsburgh, Pa. (U. S. Patent 981,767, Jan. 17, 1911). The mixture is as follows:

Lead	83-1/3 parts
Tin	8-1/3 parts
Antimony	8-1/8 parts
Vanadium	1/4 part

It is stated that the vanadium may be added in any suitable form, but the use of a 30% vanadium-copper is preferable. The amount of vanadium may vary from 1/100% to 1/2%.

The advantage claimed for the vanadium is in the use of the babbitt-metal chips and scrap for remelting. The vanadium, it is claimed, allows such material to be used without the formation of the dirt (oxide) which takes place in remelting ordinary chips or scrap babbitt-metal not containing vanadium. Beyond this, nothing more is claimed.

There is no standard mixture for phosphor-bronze, and legally any bronze which contains phosphorus, however small, can be called by this name.

Antimony is a common impurity in commercial soft solder and frequently is present in amounts up to 5%. For ordinary work it does not seem to injure the solder, but it does not flow as readily as that which is free from antimony. For the best class of work, the solder should contain no antimony. The presence of antimony in the solder usually indicates that it was made from scrap metals.

A Natural Core Sand.

By Nelson S. Flanigan.*

I have a sand on my premises which I have used personally for over a year for core making and have sold to other parties. To my knowledge there are but few if any sands on the market that will bind without some body like flour or similar substance. It has sufficient body so that no flour or other binder is required in making a core, and is simply moistened with molasses water or other substances of this nature, the core made and dried. This is a great factor in the cost of cores.

After baking, the cores are very porous and allow the gases to escape. The fact that no binder like flour is used means that very little gas is formed which is an important matter in

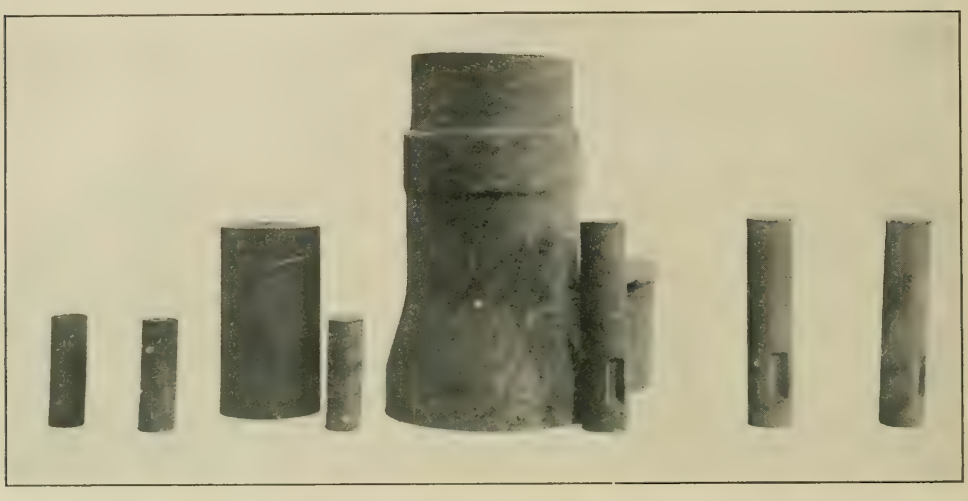


Fig. 1. Cores Made from the Natural Core-Sand.

This sand is especially adapted for the making of small cores and an assortment of them made of it is herewith shown in Fig. 1. core making. The cores are quite smooth and as the sand is of light weight a light core is produced. A remarkable feature of the sand

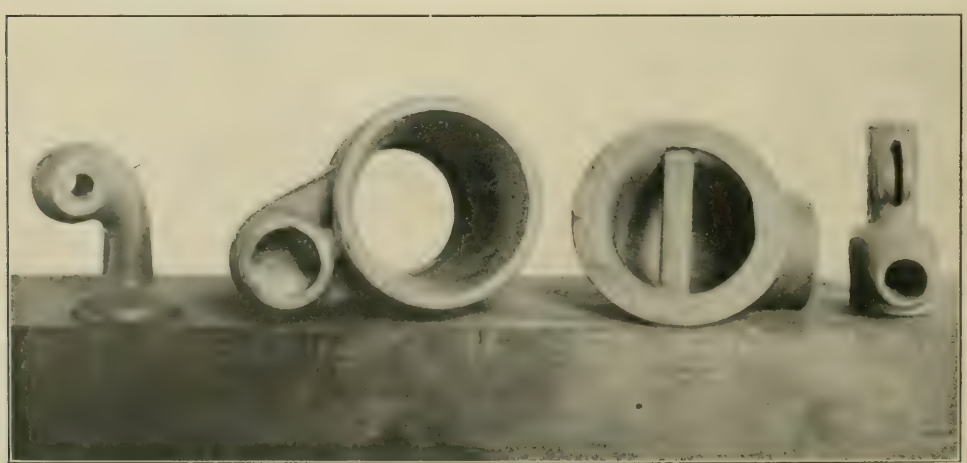


Fig. 2. Castings Made of Cores in Which the Sand was Used.

*Address, Nelson S. Flanigan, R. F. D., West Cheshire, Conn.

is that it does not adhere to the inside of the casting, but leaves it clean and smooth so that machine work may be done upon it without

the necessity of further treatment. Some castings made with cores of this sand are shown in Fig. 2.

The sand has a reddish shade, similar to the well known Windsor-Locks material. It is quite fine so that the core has a surface suitable for the finest kinds of brass castings.

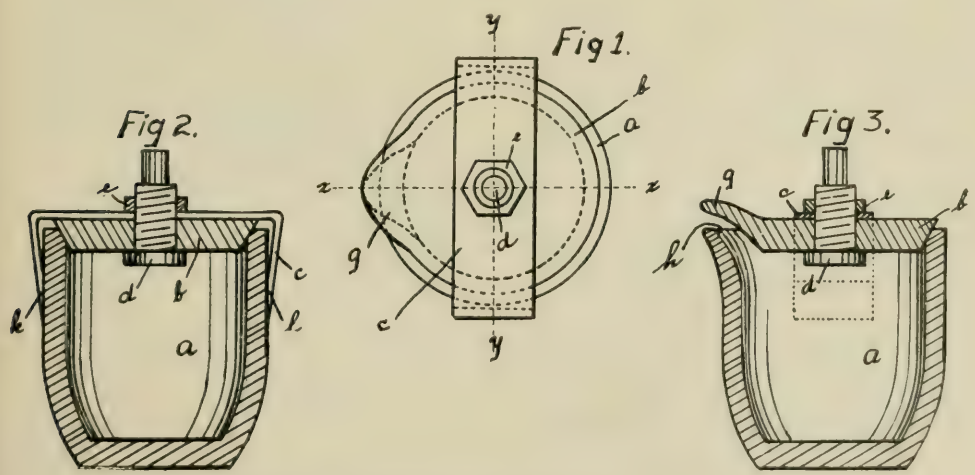
I would like to send samples of this sand to those who are desirous of improving their cores and cheapening them at the same time. It has given me the best results of any sand I have used for this purpose.

A Crucible Cover.

A cover for use on graphite crucibles when pouring metal from them has been patented by Thomas McGrath of New Britain, Conn. The cover is herewith illustrated. It is placed on the crucible just before pouring and remains on it while the pouring is carried out.

The cover *b* is made of the regular graphite crucible material and has a hole through the center. A spring clamp *k* and *l* is fastened to the cover by a bolt *d*. The cover is placed on the top of the crucible and the springs, pressing tightly against the sides, hold it in place.

The inventor says: "The use of this cover results in the production of better and more uniform castings, makes a great saving in metal, saves labor of skimming or removing of dross prior to pouring the metal, and saves the service of an extra man with a skimmer, tongs or other implements necessary to hold covers in place while the metal is being poured by the molder."



Method of Making and Using the Crucible Cover.

Magnesium and Zinc Alloys for Air-Ship Construction.

In a patent recently issued to Walter Rübel of Berlin, Germany, for an alloy of magnesium and zinc, it is said that "It is known that owing to the development of the airship, and in the construction of submarine and torpedo vessels, a brisk demand has arisen for a material of very low specific gravity, but which will still present adequate strength. In cases where lightness is of special importance, some constructors use aluminum. This material presents a number of defects, some of which are that in the lathe it cannot be worked at all without employing oil or soapy water and it likewise presents far less resistance to atmospheric influences than was heretofore thought."

It is claimed by this inventor that an alloy of zinc and magnesium is a very suitable material for air-ship construction. The use of a small quantity of zinc greatly strengthens the magnesium, both for castings and for rolling into sheet. The use of the following mixture is advocated:

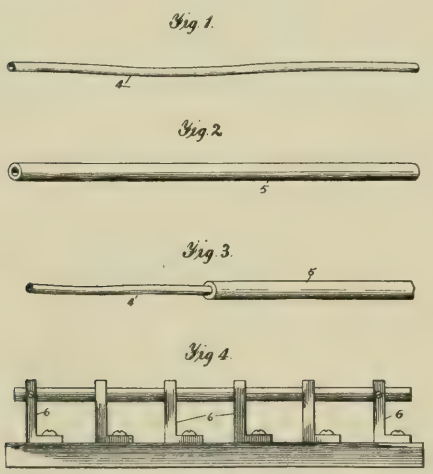
Magnesium	96%
Zinc	4%

With even 1% or 2% of zinc, the magnesium is greatly strengthened. It is unnecessary to

use pure zinc, and the commercial article answers well. The alloy may be made by first melting the magnesium in an iron crucible provided with a well fitting cover. When melted, the zinc is added and the whole stirred. The melting of the magnesium must take place with exclusion of air. It is stated by the inventor that the fracture of the rolled alloy has a fine structure like that of steel. It can be rolled or cast and machined without difficulty.

Method of Straightening Rods or Tubes.

A method of straightening rods or tubes has recently been patented by Joseph B. Fischer of Chicago, Ill. (U. S. Patent 981,407, Jan. 10, 1911). The process is applied more particularly to the straightening of light steel tubing which has been hardened.



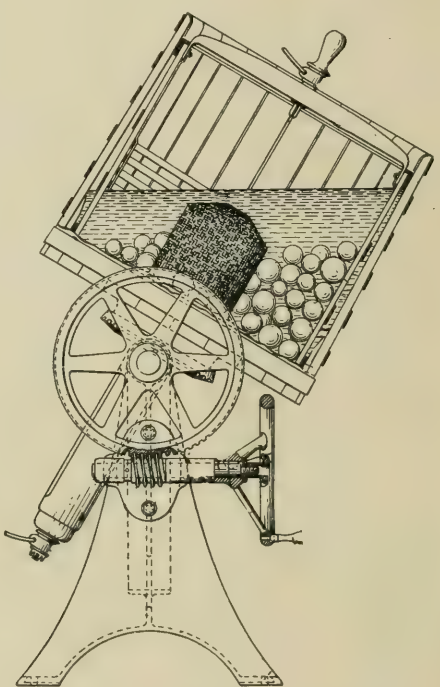
Method of Straightening Tubing.

The tubes are placed inside of a larger and heavier one and the whole heated to 500 or more degrees Fahrenheit. The tubes are clamped as shown and allowed to cool when it will be found that the tube is now straight.

The more aluminum an aluminum-bronze contains, the softer it is while hot. This is the reverse of hardness of the cold bronzes. While a 10% aluminum-bronze is much harder than a 4% bronze while cold, it is very much softer while hot and can be rolled hot much easier.

Improvement in Oblique Plating Barrels.

An improvement in oblique plating barrels has been patented by Marcellus Reid of Cleveland, Ohio, (U. S. Patent 981,004, Jan. 10, 1911). The barrel is made of the oblique tilting type and is tilted by means of a hand wheel and worm. The anode is in the form



New Form of Oblique Plating Barrel.

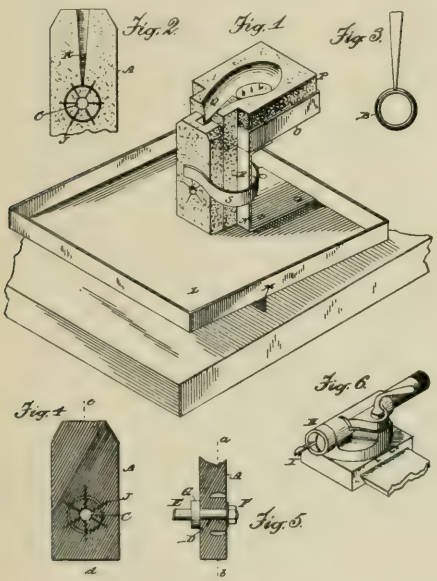
of plates in the center of the barrel and is of rolled metal (the inventor states that rolled metal is preferable to cast in his apparatus) and is protected by a cage shown in the illustration. This cage is made of wood and is perforated.

The cathode is in the form of copper strips extending spirally around the outside. The barrel is fitted with a cage and the cathode strips form the outside of this cage. It is intended to be lifted out with the work when necessary. The outside or barrel proper is made of wood staves in the usual manner.

A Novel Method of Casting Gold Rings.

A novel method of casting gold finger rings has been patented by Lawrence W. Swem of West Liberty, Iowa. (U. S. Patent 981,033, Jan. 10, 1911). The method used is as follows:

In the drawing A denotes the mold, which in practice is made of a small slab of fine charcoal. In this is shaped a matrix for the article to be cast, a finger ring B being here shown. In casting this, or any other object, it is of course desirable that the cast be clean and smooth. This is done by forming the



Method of Casting Gold Rings.

entire matrix, except one edge, in a single block or slab. It is evident that if this be done and the flat face of the mold be closely abutted against a flat surface, the ring will cast clean and whole, with no fins and no possible offsets. Such a cast is very easily and quickly finished, and with practically no waste in filing and polishing.

In the slab of charcoal is bored a small hole C of a suitable size to fit the spindle of a driver D having a suitable shank E to be held in a lathe chuck. The slab is held by a nut F against a shoulder G, as shown. In a chuck H, which is here shown as a part of a lathe slide-rest, but might be attached to the tail-stock spindle, is secured a thin, semi-circular tool I, the blade of which corresponds to a cross section of the ring. The stem of this tool should be no thicker in any direction than the back of the blade, and this corresponds to the thickness of the edges of the ring. While the slab is revolved rapidly, this blade, back edge up, is used as a parting tool, and forced straight into the slab. When it has reached the proper depth it is carefully turned on the axis of its slender stem. In this way the matrix may be counterbored either outwardly or inwardly, to produce the desired curving or "crowning" of the ring. This done, the tool is turned to its original position and withdrawn. The matrix so formed is vented by sawing thin slits J from the central hole outwardly. In practice the molten metal does not enter these slits. A gate K is formed by sawing a tapered channel from the matrix outwardly, the material between the saw-kerfs being split out with a knife or chisel. It is now only necessary to clamp a flat slab against this side of the mold, and pour the molten metal in at the gate from any suitable crucible.

In Fig. 1 is shown a device by which melting and casting is facilitated. L is a rectangular pan, provided with a foot M rear its middle. N is a bracket attached to the inside of the pan, and supporting a tray O, which holds a crucible P composed of a block of charcoal cupped at the top to take a small charge of metal, and provided with a suitable spout Q by which the cup may be emptied. A small slab of charcoal R fits against the face of the bracket under the spout and flush with the outer end thereof. The mold is held against both by a clamp S, the mold gate registering with the groove in the crucible spout. When resting in its natural position, as shown, the metal is melted by a torch or blow-pipe. The pouring is done in a moment, and without spilling over, by simply depressing the front edge of the pan. After casting, no attempt is of course made to preserve the mold, but its cost is so trifling as to be much more than compensated for by the smooth and perfect casting produced by it.

Gold is the most malleable metal, but the presence of as small an amount as 0.0003% of antimony will cause it to crack in rolling.

A New and Novel Electroplating Apparatus.

A new and novel electroplating apparatus has recently been placed on the market by the Meaker Company, 218 North Elizabeth St., Chicago, Ill., the well known electrogalvanizers and manufacturers of electrogalvanizing equipment. The apparatus is herewith described by this company:

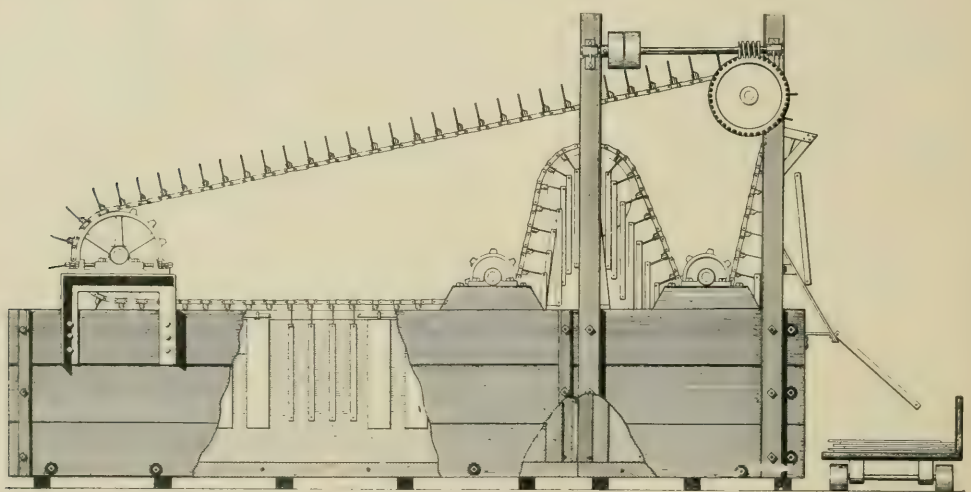
"This machine was originally designed for galvanizing large quantities of cross arm braces, all sizes, and of course is most feasible for galvanizing or electroplating similar goods in quantities, also short rods, strips, tubes, etc.

It has been our experience that a great many concerns do install electro-plating machines for handling a certain staple article said machine constituting their full equipment in their plating department; realizing this existing condition also knowing that said manufacturers frequently desire to electro-plate miscellaneous material, we have designed this machine so that it can be converted into an ordinary still plating tank in a very few minutes by simply raising the chain and attachments, making it possible to have two complete equipments in the one machine.

Material electro-plated in this machine receives a uniform coating, either a light or heavy deposit as is desired for the reason that the deposit is controlled by speed of conveyor chain which can be varied.

The pieces are hung in at one end of tank on copper hooks extending from chain, passed through plating solution and they are then automatically raised up and out of machine and lowered into hot water rinse tank, again raised and automatically discharged on truck, plated, rinsed and dried.

As shown in cut, material is fed vertically through machine between rows of anodes and this cathode arrangement prevents any part of the work being shaded by contact points or sliding contacts and further avoids pocketing of hydrogen gas as is the case when goods are conveyed through any plating solution horizontally. It is a well known fact that hydrogen gas clings to the bottom of flat surfaces but the anode and cathode arrangement in this machine avoids this bad feature.



The New Meaker Apparatus for Electroplating Articles Automatically.

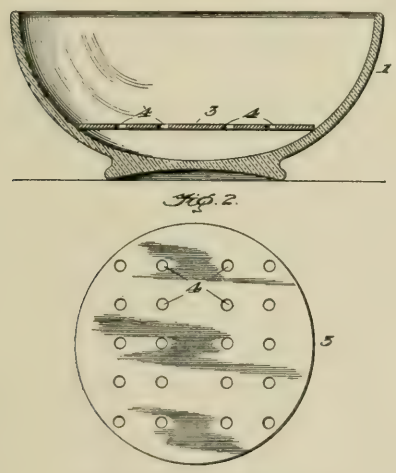
While goods are being plated they are always in plain view of the operator and pieces can be taken out, examined, and put back without loss of time. This feature also makes it possible to immediately detect improperly cleaned work. Another strong feature is that all mechanism is above the solution; any part can be taken off and repaired without taking the solution out of the tank so the time lost by repairs is kept at a minimum. Electrical contacts are made of bus bar copper and all sliding contacts are automaticlly kept clean so there is no arcing or loss of current. The anode rods are connected by flexible cable and are arranged so that they can be adjusted the proper distance from the work making it

easy to get a very high current density without excessive voltage, consequently without waste of power.

The "Meaker" self-sustaining, electro-galvanizing solution being especially adapted for this machine, because of its high current density, makes it possible to deposit a 4 test coating of zinc in 10 minutes time.

New Form of Electrolytic Apparatus for Cleaning Metals.

A new form of electrolytic apparatus for cleaning metals has been patented by Henry E. Genet of New York City. (U. S. Patent 980,627, Jan. 3, 1911). The apparatus is quite simple. A perforated aluminum plate is set in a bowl of chinaware or enameled metal and



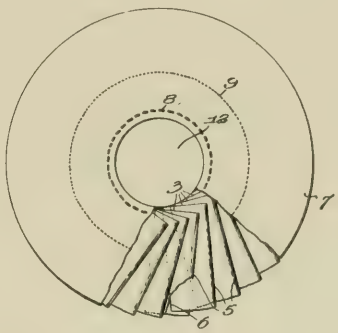
Apparatus for Cleaning Silver.

the metal to be cleaned is placed on it. The cleaning is applied more particularly to silverware. A solution, made by dissolving ½ lb. of caustic soda in 1 gallon of water, is then poured in the bowl and in a few minutes the tarnish will be removed from the silver. An electrolytic action is set up which reduces the film of sulphide on the surface of the silver.

Oil of vitriol and sulphuric acid are the same. The ordinary strength sold is 66° Beaumé. When it is weaker than this (i. e. stands less by the hydrometer) it contains water.

New Form of Buff Wheel.

A new form of buff wheel has been patented by John C. Codman of the firm of F. L. & J. C. Codman of Boston, Mass., the well known buff manufacturers. The manner of making it is herewith shown. The object is to economize on cloth and to obtain the greatest possible wear.



New Form of Buff.

The buffs are made up of a series of circularly arranged pieces, each made of a quadralateral piece of the cloth folded at right angles. The folded members are then interleaved and overlapped leaving the finished wheel of the appearance shown. The folds diverge from one another as they approach the circumference so that a series of pockets are presented which serve to hold and retain the polishing material.

Metal Welding Apparatus in Germany.

According to U. S. Consul A. M. Thackera of Berlin, Germany, the autogenous welding of metals is extensively carried on in that country. Practically all the larger manufacturers of metal wares, tubes, automobiles, bicycles, boilers, etc. have their own welding plants.

The welding is done by means of the oxy-acetylene blowpipe. Hydrogen gas was at one time used in place of acetylene for use with the oxygen, but it has been found that it requires several times as much to do the work, although the price is about the same per cubic foot.

Questions and Answers.

QUESTION No. 928. What is the effect of silicon on yellow brass castings? We have been trying it with the idea that it might render it more non-corrosive. We have not been very successful, however, and would like information on the matter, if possible.

Answer. We are unable to give you much information on the effect of silicon on yellow brass as we have never had much experience on the subject. As far as we know, silicon will have about the same effect as aluminum in that it promotes soundness and produces a good surface on the castings. Owing to the cost of silicon being greater than aluminum, the latter is used instead of it. Silicon is used in the tin bronzes and in copper extensively and it may be possible that it would have an effect on yellow brass not heretofore known. Experiments would be necessary to ascertain it.

QUESTION No. 929. We have some articles to silver plate very heavily and which have a small letter in the front. This letter must be gold plated. We would ask if you have a formula for a gold paste with which to gild these letters? If not, would ask if you can suggest any other way in order to leave the letter gilded on the silver plated base?

Answer. The best method of doing the job is to first silver plate the whole article, letters and all. Then with a suitable stopping off varnish (stopping off varnish can be obtained that will stand hot cyanide solutions) paint the silver back-ground, leaving the letters exposed. Then gild the whole. Only the letters will be plated with the gold. The stopping off varnish can then be removed and the article will be left in the desired condition. You can, of course, first silver plate the whole article and then sponge-plate the letters, but if they are small, it may be difficult to keep the gold from running over the outline.

QUESTION No. 932. Will you kindly give us the mixture for the so-called "Kaiserzinn" metal? Can hollow-ware be made from it?

Answer. This is a metal used in Germany at one time quite extensively for making fancy hollow-ware and art metal goods. It is practically the same composition as our own britannia-metal. It consists of the following:

Tin	93 %
Antimony	5½%
Copper	1½%

It can be used for casting or spinning and for any purpose for which britannia-metal is used. In fact, it is britannia-metal.

QUESTION No. 933. We have a job of gold plating on aluminum. Is it possible to gold plate directly on the aluminum, or must it be copper plated first?

Answer. You can gold plate the aluminum directly, but will find it better as regards color if you copper plate first. We have never seen a job of gold plating, however, that did not sooner or later peel off. This seems to be a difficulty in plating aluminum. As far as we have been able to discover, no one has yet solved the problem of plating aluminum.

QUESTION No. 934. We have a customer who wants a mixture of 97.5 parts of copper, 2.5 parts of tin and 0.03 parts of phosphorus. It must be drawn into wire. We find it very hard and spilly and it cannot be rolled hot. What causes the hardness in rolling?

Answer. If you are not exceeding the amount of phosphorus given, the metal should roll hot. Possibly you are casting the metal too hot. It should be cast at as low a heat as possible. Frequently tin bronzes work better on the second melting, but you should have no difficulty in rolling the mixture you mention, even when melted but once. As it is quite an easy mater to exceed the desired amount of phosphorus, we believe that there is a possibility that you have done this, and if so it would cause the bronze to crack. Tin bronze for rolling should not contain over 0.05% phosphorus.

QUESTION No. 935. I wish to produce a heavy deposit of pure silver by electrodeposition and find that by taking out and scratch-brushing, layers are formed. If not scratch-brushed, the deposit is rough. How can a smooth, homogeneous deposit be produced?

Answer. The only method is to take out and scratch-brush when the deposit becomes rough. Possibly you are not cleaning the silver after scratch-brushing and before redepositing the silver. This will form layers. Run through a cleaning solution and then through cyanide previous to depositing the silver again. Do not force the deposit as this will cause roughness. You will have to deposit at the regular speed and let the operation take its own time.

QUESTION No. 936. We are making an ingot metal to the following specifications: Copper, 70%; zinc, 24%; and lead 6%. What we would like to know is, if we can make this ingot to the same specifications and still have it red or of a reddish shade instead of yellow. As now made to the preceding specifications, it is yellow. The fracture and hardness must be the same as the yellow ingot.

Answer. You are trying to accomplish something impossible. The color of brass varies with the mixture, and if you want to preserve the mixture, you will still have the yellow color. Brass containing from 55% to 60% copper and the remainder of zinc, has a reddish shade, but you cannot cast it in sand without the use of a small amount of aluminum. You are apparently endeavoring to produce a red brass ingot from a yellow brass mixture. This has never been done and is metallurgically impossible.

QUESTION No. 937. I have made a blue oxidizing solution using 2 oz. of acetate of lead and 2 oz. of hyposulphite of sodium in a gallon of water, and am using it to produce a blue color on tin. I first copper plate the

tin and then immerse in the solution while hot. A very fine blue is obtained. I then lacquer it. After it has been exposed to the light, it changes to a brown color. How can the fading be prevented?

Answer. You cannot prevent the fading as it is characteristic of the finish. By rinsing well and using good lacquer (free from acid) it can be preserved for some time, but it will sooner or later fade. If not exposed to the light, it will remain in its original color for a long time, but when exposed to sunlight it fades rapidly. It is to be regretted that such is the case for it is a brilliant finish and one that is easily and cheaply produced.

QUUESTION No. 938. Kindly submit a formula for a bronze bushing giving a high wearing quality and a high elastic limit. We have had trouble with bushings which run in hot oil, expanding and contracting. The continued heating and cooling in the oil, when not running, finally reduce the bushings in size both inside and outside so that they become loose in their outside fits and grip the pins which work inside.

Answer. We hardly know how to advise you as this is a problem that has never before been brought before us. We doubt very much whether you will find much difference in the expanding and contracting properties of any of the bronzes, and in our estimation, we believe that you will find any bronze bearing metal as good as another for your purpose. Are you sure that there is not some other cause for the loosening of the bushing?

QUUESTION No. 939. In making brass name plates by etching, why is it that the majority of etchers use perchloride of iron as the etching solution? It works slowly and does not seem to be as good as nitric acid or other solutions that will do the work.

Answer. The brass name plates now manufactured by the etching process are made by covering the brass with a sensitive enamel, then printing on it through a negative in the light, and afterwards washing away the portions not acted upon by the light. This leaves the brass exposed for etching. The reason that perchloride of iron is used is that it does not act upon the enamel. This enamel is quite thin and strong solutions are apt to attack it. As deep etching is not required in name plate work, the perchloride of iron answers well.

QUESTION No. 940. We desired to make up a mixture of red brass as follows: Copper, 82%; tin, 6% lead, 6%; and zinc, 6%. Instead of adding the zinc, however, we added antimony. Is there any way of eliminating the antimony from the mixture?

Answer. You will not be able to eliminate the antimony from the mixture, but if you take half of your regular mixture and half of the one containing antimony, you will have a red brass that can be used for many kinds of work. Antimony is often used in place of tin in red brass, but only to the extent of a few percent. By mixing the two, however, you will reduce your antimony so that the red brass will not be particularly bad, although it will be found rather deficient in strength. it can be used for making red brass castings that are not required to be strong. There is no other method of using it or eliminating the antimony.

QUUESTION No. 943. What is the best method of producing an ormolu or dead finish on brass? We do not mean by the use of gold, for we do not desire to use this metal, but we refer to the satin-finish or dead surface found on brass articles.

Answer. The best method of producing the matt finish on brass is by means of a sand blast. While it can be done by the acid dip, the sand blast is far more efficacious and can be used on all kinds of brass. When the brass has been sand blasted, however, it will be found dirty on the surface. In order to bring out the bright or brilliant lustre to the dead surface, the brass should then be run through a bright dip composed of equal parts of strong sulphuric acid and strong nitric acid containing about ½ oz. of common salt to each gallon of the dip. Unless this is done, the dead surface will not be satisfactory.

QUESTION No. 945. I am metallizing some leaves and am not meeting with much success. I dip the leaf in shellac and when dry, dip it again and dry once more. I then dust on plumbago and when dry, hang in an acid copper solution. The deposit forms near the wire but will not cover the leaf all over. The plumbago does not seem to have the conducting power. Will the addition of dextrin to the copper solution overcome it? How can the deposit be made smooth and free from warts? What kind of dextrin should be used, the yellow or the white?

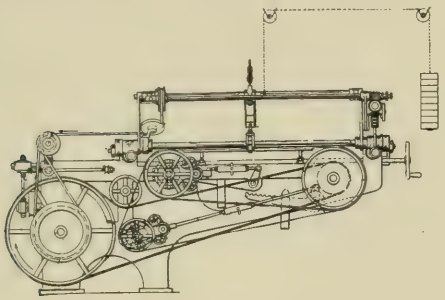
Answer. If you use copper powder, which can be obtained in the market practically as fine as plumbago, you will be able to obtain a good deposit in the copper solution. It is used like plumbago. When the leaf has been covered with it, immerse in a cyanide silver solution containing as little free cyanide as possible. Use no current on it, but only as a dip. The copper will change to silver on the surface. The deposition of the copper can then commence. The substitution of the copper for the silver will cause the copper to deposit rapidly. The use of dextrin will assist you only in obtaining a smooth deposit. The yellow material is satisfactory.

QUESTION No. 947. Can the crystallized or snow-flake finish be produced by any known method on rolled brass sheet? I wish to use this finish on some goods which are part castings and part sheet. While I can produce the finish on the castings, I have not been successful on the sheet.

Answer. You cannot produce the snow-flake finish on the rolled brass. The "flakes", as formed on brass castings are the crystals produced by the slow cooling of the metal in the sand mold. When brass is rolled, these crystals are broken up into fine ones. As you have undoubtedly noticed, the surface produced on rolled brass in the solution used for the snow-flake finish, is fine and dead, but shows no crystals to the naked eye.

Patent Abstracts.

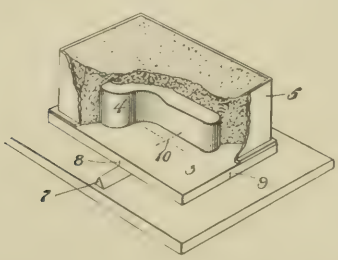
980,052-980,053-980,054. GRINDING AND POLISHING MACHINE. John C. Blevney and John Hausman of Newark, N. J. Machines for the grinding and polishing, in



an accurate manner, of a large variety of small metal goods. A number of articles may be polished at the same time, and with the production of a superior finish.

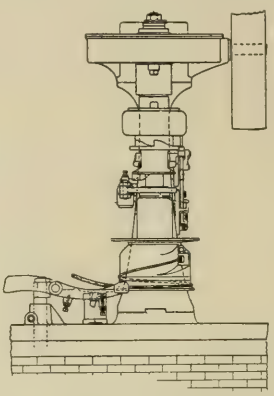
979,931, Dec. 27, 1910. SCALING, ANNEALING AND COATING METALS. Sherard Osborn Cowper-Coles of Westminster, London, England. Assignor of one-half to Metalloids, Ltd. of Tipton, England. A method of removing the scale or oxide from iron or steel wire. The wire is passed through a muffle heated to redness, and water gas passed in which reduces the oxide to metal. The wire is then passed to another or cooling chamber still filled with the reducing gas in which it cools so that it may be passed directly to the galvanizing or tinning kettle.

980,994, Jan. 10, 1911. METHOD OF JOLT RAMMING MOLDS. Edgar H. Mumford, Philadelphia, Pa. The primary object of the invention is the prevention of uneven wear of the plunger and the cylinder commonly



incident to work of this character, resulting from the fact that the molds are generally placed upon the machine without regard to the centers of gravity.

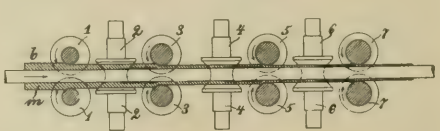
980,569, Jan. 3, 1911. WIRE DRAWING MACHINE. Lester C. Smith of Rome, N. Y. Assignor to the Coe Brass Mfg. Co., of Torrington, Conn. A wire drawing machine in which provision is made for starting the wire



at a reduced speed from that of the block, and then gradually increasing the speed until the speed of the block is obtained. An improved means of grasping the wire is also provided.

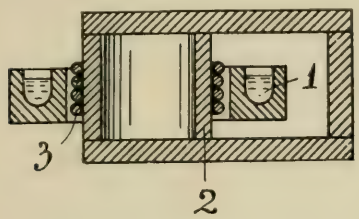
982,218, Jan. 17, 1911. PROCESS OF MAKING ALUMINUM AND COPPER ALLOYS. Joseph Grenville Mellen and William Francis Mellen of Bridgeport, Conn. A method of making aluminum bronze. The copper is melted in a crucible and then the aluminum added, after which a mixture of potassium bi-chromate and borax is added as a flux. One-half a pound of potassium bi-chromate and one-quarter of a pound of borax are used. It is claimed that the use of the potassium bi-chromate renders the bronze more inert so that it will resist the action of acids to a marked degree. It is also claimed that the addition of silicon improves the bronze in that it gives sharper castings.

984,281, Jan. 10, 1911. CONTINUOUS ROLLING MILL. Julius Kalle of Dinslaken, Germany. A mill for the continuous rolling of tubing. Each succeeding pair of rollers in



the mill are arranged with their axes at right angles and in which the mandrel is moved forward with the material to be rolled.

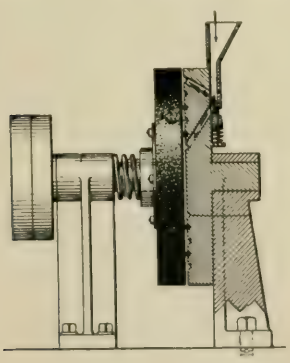
980,259, Jan. 3, 1911. ELECTRIC INDUCTION SMELTING FURNACE. Karl Albert Fredrik Hiorth, Christiana, Norway. In electric induction furnaces for melting metals in which the primary winding is located between the furnace groove and the magnet



core, it is impossible to use large charges, on account of the stray losses. In the present invention it is overcome by making the magnet core or part of it hollow, and consequently enabling it to be formed with so large a diameter that it will be comparatively near the furnace groove.

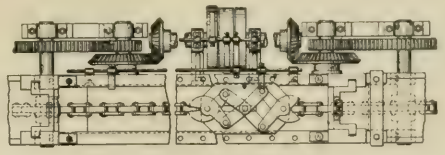
981,513, Jan. 10, 1911. PROCESS OF TREATING METALLIC ARTICLES. Thomas B. Allen of Niagara Falls, N. Y. Assignor to the Carborundum Company of the same place. A method of making articles of iron with a surface of ferro-silicon. The article is imbedded in silicon and heated to a temperature of about 1350° C. A ferro-silicon is formed on the surface .by cementation Among other articles, crucibles are mentioned. The surface of ferro-silicon renders the article acid resisting.

981,310, Jan. 10, 1911. MACHINE FOR GRINDING AND POLISHING METALLIC BALLS. Albert Ringland, Philadelphia, Pa. Assignor to the Standard Roller Bearing



Co., of the same place. The balls are fed through a spiral groove to the face of an emery wheel which automatically grinds them to the desired diameter.

981,304, Jan. 10, 1911. DRAWING MACHINE. Charles J. Perry, Detroit, Mich. A draw bench for drawing brass or copper rods, tubing etc. The bench is made "double ended"

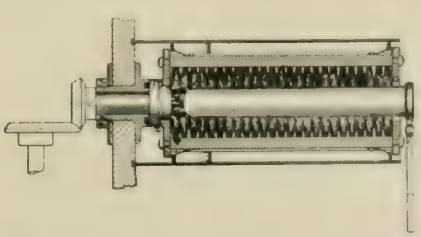


so that the metal may be drawn at both ends. The return of the carriage or tongs is then unnecesary as the drawing may be done from both ends. A saving of time is thus effected.

980,087, Dec. 27, 1910. METHOD OF GENERATING HIGH TEMPERATURES. Wm. C. Fink of Elizabeth, N. J. Assignor to George H. Benjamin of New York City. A method of producing a high temperature blowpipe flame by the use of high pressure. In the apparatus patented, the gas used is made by a producer and it is stated that the gas employed must contain as large an amount of carbon as possible. Temperatures ranging from 1200 to 3000 degrees F. may be obtained at the blowpipe flame.

979,393 and 979,394, Dec. 20, 1910. PRODUCTION OF ALLOYS OF ZINC AND TITANIUM. Auguste J. Rossi of Niagara Falls, N. Y. Assignor to the Titanium Alloy Company of New York. A method of making alloys of zinc and titanium and tin and titanium for use in alloying with other metals. The oxides are reduced by means of metallic aluminum. The alloys are used in bronzes and brasses for deoxidizing.

981,417, Jan. 10, 1911. APPARATUS FOR GRINDING AND POLISHING TUBULAR ARTICLES. William G. Halsey and John Currier of Newark, N. J. An apparatus for polishing or buffing tubes, pipes and rods. The



object is to have the apparatus so constructed that the article may be polished with varying pressure if desired. In other words, the polishing wheel is capable of adjustment.

Trade Items.

A plant for the manufacture of safes and locks is to be built by the Victoria Safe & Lock Company at Victoria, Texas. It is stated that the plant will be able to manufacture 2,000 safes per year.

A foundry and machine shop is being erected by Charles J. Stanzel at Aransas Pass, Texas and brass castings will be made in addition to iron work. Mr. Stanzel is at present located in Brownwood, Texas.

The Quick Action Range Company has been incorporated in Marshalltown, Iowa, with a capital stock of $225,000 to manufacture cooking stoves and ranges. A new plant will be built in the spring. Some patented devices will be used on the ranges.

The James E. Blake Co., of Attleboro, Mass., have discontinued the manufacture of German-silver mesh-bags and have sold the tools and machinery for making them to the Holbrook Mfg. Co., of the same place who will manufacture mesh bags on an extensive scale.

J. S. McCormick Company of Pittsburgh, Pa., manufacturers of foundry supplies and equipment, have established a warehouse and office at 318 Walker St., Milwaukee, Wis. This new department will be in charge of Joseph Harrison. A large stock of foundry supplies will be carried so that prompt shipments can be made in that vicinity.

The Automatic MachineCo.,113 East Washington Ave., Bridgeport, Conn., manufacturers of automatic machinery, have under consideration the starting of a brass foundry. They already operate an iron foundry and as they do a large amount of marine repair work, a brass foundry would be able to take care of such work as they now have done by outside parties.

The Ontario Silver Company of Muncie, Ind., manufacturers of silver plated flat-ware and steel knives, will shortly commence the erection of a new plating room. This will be in a separate building of brick and with a cement floor. The rapid increase in their business has made this a necessity and their present plating room is not large enough to turn out the necessary quantity of work.

Each year, between Christmas and New Year's, the J. W. Paxson Company of Philadelphia, Pa., the well known manufacturers of foundry supplies and equipment, give an exhibition of their products. Experts demonstrate the goods. This year, about 300 foundrymen, (iron, steel and brass) availed themselves of the opportunity. Among the foundry appliances shown were the new Whitehead flask bar tucker for tucking sand under both bars at the same time, device for stopping run-outs in a foundry flask, complete Paxson-Warren sand-blasts with latest sand-blast tumbling barrel, tram rails, hoists, jarring molding machines, new Barker rock-over molding machine with vibrator attachment etc., etc.

The Peninsular City Casting Co., has started a brass foundry at 13 West 9th. St., Bayonne, N. J., and are making brass, bronze and composition castings for the trade.

On account of the recent fire which greatly damaged the plant of the Great Western Smelting & Refining Co., of Detroit, Mich., they are now located at 12 Atwater St., in that city and are carrying on business regularly.

The Troy Wire Goods Company of Troy, N. Y., has been incorporated in Troy, N. Y., with a capital stock of $10,000 to manufacture wire specialties. Howard B. Bonesteel, H, A. Olmstead and Clifford Iler are the incorporators.

The name of the Howler Mfg. Co., of Cleveland, Ohio, has been changed to the Virden Manufacturing Company, J. C. Virden is the president of the company. The manufacture of art brass goods is carried on as well as metal spinning, electroplating and polishing. The works are located at 5107 Euclid Ave.

The firm of Hayes & McFarland of Mt. Vernon, N. Y., manufacturers of silver deposit and other silver goods, has been dissolved and Harry A. McFarland will continue the business as before. William F. Hayes retires from the firm and, it is stated, will shortly engage in the manufacture of a similar line of goods.

The J. P. Eustis Mfg. Co., have moved from their location at 92 North St., Boston, Mass., to their new factory on Ames St., Cambridge, Mass., where a new fire proof building has been erected by them. This company is known by the name of the "Brasscrafters" and manufacture bath room fixtures, metal frame mirrors, and a similar line of fine art metal goods. Electroplating is also carried on.

The new plant which the Vanadium Metals Co., will build in Groton, Conn., across the harbor from New London, Conn., will be 63 x 227 feet and of brick and steel. The company are now located in East Braintree, Mass., and succeeded the Victor Metals Co., of the same place. Victor Lassen is the general manager of the company. The contract for the foundry has been awarded and it is expected that the equipment will be purchased within a short time.

The New Haven Sand Blast Company, 47 Orange St., New Haven, Conn., announce that their sand blast tumbling barrel has met with even better success than was anticipated and that all users are enthusiastic about it. With this barrel it is possible to sand blast small metal goods of all kinds in a short time and without any hard labor at all. Such work as food choppers, valves, plumbers' brass goods, hardware etc. can be cleaned both inside and outside in about 15 minutes and are then ready for plating, japanning, tinning or galvanizing. No further argument is necessary.

The Peerless Brass Works of Detroit, Mich. have filed legal notice of their dissolution and final retirement from business.

A plant will be built by the American Stamping Company at Battle Creek, Mich., for the manufacture of oil and grease cups for automobiles.

The American Wire Fabrics Company has been incorporated in Clinton, Iowa with a capital stock of $1,500,000 and succeeds the American Wire Cloth Co. All kinds of wire cloth, cables and wire fabrics are manufactured.

The McShane Bell Foundry Co., of Baltimore, Md., manufacturers of bells and brass goods, have added about 4,000 square feet of space to their brass finishing department. The capacity of this department has been increased one-third by it.

The Rockwell Furnace Co., 26 Cortlandt St., New York City, manufacturers of furnaces for every kind of work, have issued their Bulletin R describing their "Eight in One" furnace. This is a combination tool room furnace and may be used for eight different purposes.

The firm of Hopkins & Cannon, Inc., 78 Friendship St., Providence, R. I., has been succeeded by Cannon & Brown, Inc. All work will be done under the personal supervision of Edward A. Brown so that the best of satisfaction is assured. General electroplating is carried on and a specialty made of jewelry work. The works are located at the same place.

The Mebane Mfg. Co., has been incorporated in Cleveland, Ohio with a capital stock of $10,000, to manufacture fluxes and other foundry products. This concern takes over the Homogen Department of the Allyne Brass Foundry Co., and will handle "Homogen" the well known flux. The incorporators are C. P. Mebane and others. The office and factory are at 6110 Euclid Ave.

At the annual meeting of the stockholders of the Morgan Silver Plate Co., of Winsted, Conn., manufacturers of coffin hardware, the following officers were elected: President, Geo. F. Drake; vice-president, W. S. Alling, secretary, treasurer and general manager, G. L. Hart. The following directors were elected: W. S. Alling of Norwich, Conn.; James McAlpine, Geo. F. Drake, E. B. Parsons, S. E. Granger and G. L. Hart.

The *American Metal Market & Daily Iron and Steel Report*, 81 Fulton St., New York City, have issued "Metal Statistics" for 1911 which will prove of value to all metal purchasers. It is a book of 208 pages and giving a large amount of statistics on copper, tin, lead and zinc as well as iron and steel products. It is a book of reference and will always be of assistance to metal users. The book is bound in red cloth and may be obtained from the above publishers. Some new matter, not heretofore published, is contained in this new edition.

The addition to the brass foundry of the Crown Electrical Manufacturing Co., at St. Charles, Ill., has been completed.

The Hartford Metal Goods Manufacturing Works has started business at 62 Market St., Hartford, Conn., and are making stampings in brass and steel. They also manufacture hardware specialties to order, dies and tools and other similar lines of work.

The Seymour Mfg. Co., of Seymour, Conn., are now making a specialty of phosphor-bronze in the form of sheet, rod and wire and solicit inquiries about it. They make special grades for use in the electrical trades as springs and other work.

Arthur D. Little, Inc., chemists and engineers, 93 Broad St., Boston, Mass., have been appointed official chemists for the American Brass Founders' Association and will analyze foundry products for members of the association when desired. It is also stated that research work will be carried on.

The Taylor & Boggis Foundry Co., of Cleveland, Ohio, manufacturers of builders' hardware, hardware specialties, and electroplaters, have sold their property on East 59th. St., in that city to the Pennsylvania R. R., and will shortly erect another plant. The old plant will be torn down. A new site has not yet been selected.

The Balbach Smelting & Refining Co., of Newark, N. J., desire to announce to the trade that they purchase copper bearing materials of all kinds and that consignments are handled in accordance with the most modern practice. Any class of material that contains enough copper to be of value will be purchased by them.

The Hamilton Facing Mill Co., Hamilton, Canada, manufacturers and dealers in foundry supplies and equipments, which had under consideration a short time ago, the manufacture of plating and polishing supplies, such as rouges, polishing compositions, wheels, etc., have now decided not to enter this new business at the present time.

The Frontier Brass Foundry, Lebherz & Phipps, proprietors, Whitney Ave., Niagara Falls, N. Y., have let a contract for a new brass foundry of concrete and steel construction. Twelve furnaces will be installed. The manufacture of brass, bronze, aluminum and copper castings is carried on and a specialty made of general jobbing work.

At the recent annual meeting of the Detroit Foundry Supply Co., of Detroit, Mich., manufacturers and dealers in foundry supplies, foundry equipment and electroplating and polishing supplies, W. J. Woodison resigned as president and general manager and was succeeded by W. Bruce Howard. Merrill Z. Fox, formerly with the Hill & Griffith Company of Cincinnati, Ohio, was elected vice-presid ent. R. S. Ray was elected secretary. H. E. Moyer has also associated himself with the company and will travel in the Middle West and Canada for them. J. H. Lyle will cover the Western territory.

The National Brass & Iron Works of Reading, Pa., manufacturers of art metal goods, have made an assignment for the benefit of their creditors.

The Herschede Hall Clock Co., 1011 Plum St., Cincinnati, Ohio, are to equip a department for gold plating at their plant and are desirous of obtaining a gold plater. They manufacture clocks of the highest grade.

A new catalogue has been issued by the Globe Machine & Stamping Co., of Cleveland, Ohio, on the "Globe" tumbling barrels and which will be sent to all interested. They also issue the "Sherardizing" book.

The Delphos Mfg. Co., of Delphos, Ohio, manufacturers of oil cans and sheet metal goods, is to establish a galvanizing plant in some other locality. A site in Knox, Ind., is under consideration.

The Crager Wire & Iron Works has been incorporated in Salt Lake City, Utah, with a capital stock of $50,000. The business of the old firm of this name has been taken over. The manufacture of ornamental wire and iron work is carried on.

A new plant for the manufacture of adding machines is to be established in Nashville, Tenn., by Charles Wales, formerly with the Adder Machine Co., of Wilkesbarre, Pa. A company is now being organized for this purpose.

The Exeter Machine Works, Pittston, Pa., have entered the manufacture of manganese-bronze and other bronzes on a more extensive scale than heretofore and are soliciting jobbing business. They are manufacturing "Stones Manganese-Bronze," "Navy White Bronze" and "Vita Acid Resisting Bronze." Rough or finished castings are supplied in these alloys.

The G. L. Anderson Brass Works of Birmingham, Alabama, has been incorporated by G. L. Anderson and J. M. Anderson. A jobbing brass foundry business will be carried on. G. L. Anderson is the president of the company and J. M. Anderson secretary. The company succeeds G. L. Anderson who has conducted a brass foundry for some time in that city.

The new plant of the American Detinning Company at Connellsville, Pa., is now finished and operations commenced. The main building is 50 x 60 feet and two stories high. Several smaller buildings have also been erected for storage purposes. The detinning of bright tin-plate scrap will be carried on. A hydraulic press for compressing the scrap will be installed.

The Durlacque Mfg. Co., 2322 Olive St., St. Louis, Mo., manufacturers of lacquers, have issued their new catalogue on lacquers and in which they say "The Making of Fine Lacquers is an Art, and We are the Artists." The booklet describes the various products which they manufacture and also contains additional information that will prove of much interest to the lacquer user. The booklet will be sent to those who desire it.

The Cummings, Brass, Iron & Wire Company are to erect a factory in Winnipeg, Manitoba.

The Standard Brass & Metal Works has been organized in Nashville, Tenn., by J. L. Malcolm and others.

A new brick brass foundry, is being built by the Crescent Brass Mfg. Co., of Reading, Pa.

The American Oil & Supply Co., 46 Green St., Newark, N. J., have started to manufacture felt buffs, cones and wheels for polishers' and platers' use.

The business that Oscar G. Thomas has been conducting at Taunton, Mass., for the manufacture of stoves, has now been incorporated under the name of the Oscar G. Thomas Co., with a capital stock of $50,000.

The brass foundry ogf Vogel & Swan of Madison, Wis., was recently damaged to the extent of $2,000 by fire with practically a total loss. The foundry was located on Waubesa St., and will be rebuilt.

The Rome Tube Co. and the Rome Metal Co., of Rome, N. Y., both affiliated with the Rome Brass and Copper Co.. have been merged under the name of the Rome Tube Co. The plant will probably be moved to the works of the Rome Metal Co.

Alexander Gauld, formerly with the Labatt Mfg. Co., of London, Ont., manufacturers of plumbers' brass goods, will shortly start a new company for the manufacture of brass goods and it is expected that 100 men will be employed. Plumbers' brass goods will be made and a brass foundry willi be built.

Albert J. M. Lein formerly of Manchester, N. H., has moved to 85 Wickenden St., Providence, R. I., and is engaged in coppersmithing and the manufacture of ornamental sheet brass and copper work as heretofore. He also deals in scrap brass, copper, German-silver and other non-ferrous metals, and does tinning for the trade.

The Booth Copper Company of Toronto, Canada and Wm. Coulter & Sons, of the same city, both brass founders and manufacturers of fire department, brewers, sugar refining and marine work, have consolidated under the name of the Booth-Coulter Copper & Brass Company, Ltd. The office and works of the company is at 115 Sumach St., Toronto, and a branch office and factory is at 19 Queen St., Montreal.

A new company called the Fishel-Nessler Company has been formed to take over the business of Fishel, Nessler & Co., which recently went into bankruptcy. The business will be continued as before with T. H. Fishel as general manager. Martin Wortman of Ludwig Baumann & Co., of New York City is president. The company is located at 81 Crosby St., New York City and manufacture silver goods and jewelry. Among the assets were 3,636 shares in the Year Clock Company of Mt. Vernon, N. Y., owned personally by T. H. Fishel.

The Eagle Brass Works of Detroit, Mich., brass founders and manufacturers of plumbers' brass goods, are retiring from business.

The Chicago Fuse Wire & Mfg. Co., of Chicago, Ill., manufacturers of electric specialties, have changed their name to the Chicago Fuse Mfg. Co.

At a meeting of the stockholders of the Crane Co., of Chicago, Ill., manufacturers of valves, it was voted to increase the capital stock from $13,000,000 to $17,000,000.

The Great Lakes Manufacturing Co., of North Chicago, Ill., will rebuild its plant which was destroyed by fire on January 4th. The loss was about $15,000. Hardware specialties are manufactured.

The Wire Specialty Works, 549 Fulton St., Chicago, Ill., which started some time ago in the manufacture of wire goods, has now commenced the manufacture of automatic machinery. Special machines for wire working will be manufactured.

The Ramsey-Vance Sales Company has been formed in Madison, Wis., for placing on the market a patent silver cleaning pan for cleaning the tarnish from silver and silver plated ware. This pan is patented and cleans the ware by electrolytic action. It is intended for household use. The office of the company is at 354 Washington Building in that city.

The Bay State Brass Co., of Haydenville, Mass., manufacturers of plumbers' brass goods, will resume business under the management of S. S. Cassard who represented the creditors during the recent bankruptcy proceedings. The property was recently sold at auction to H. J. B. Willis of the Nassau Bank of New York City.

At the annual meeting of the Standard Underground Cable Co., of Pittsburgh, Pa., recently held, the following directors were elected: L. W. Dalzell, John Moorehead Jr., J. N. Davidson, B. F. Jones Jr., A. H. Childs, J. W. Marsh, W. A. Conner, F. A. Rinehart, and Joseph Wood. This company also has works in Perth Amboy and manufacture copper wire and cables.

The Foreign & Domestic Metals Co., Inc., has been organized in Cleveland, Ohio and will import, export and deal in all kinds of metals such as pig copper and tin, aluminum, antimony, lead, spelter etc. Metals will be carried in stock. The office is at 576-578 Rockefeller Bldg. Henry L. Schwarzenburg, well known in the metal trades, is connected with the company.

G. J. Nikolas & Company, 1227-1229 West Van Buren St., Chicago, Ill., manufacturers of lacquers, have issued a new catalogue of their products which will prove of interest to all lacquer users. The book is entitled "The Famous Nikolas Lacquers" and contains a description of their various products with methods of applying them. Chapters on spraying lacquers and use of spraying machines will prove of much interest. The use of gold dye lacquers is also described.

Personal.

David Burgess, formerly with the Winchester Repeating Arms Company of New Haven, Conn., has become master mechanic of the Michigan Copper & Brass Co., of Detroit, Mich.

Benjamin F. Brusstar, formerly in charge of the brass rolling mill of the Winchester Repeating Arms Co., of New Haven, Conn., has taken the position of general superintendent of the Michigan Copper & Brass Company of Detroit, Mich.

William A. Beveridge, formerly foreman of the brass foundry of the Bridgeport Deoxidized Bronze & Metal Co., of Bridgeport, Conn., has accepted the position as assistant foreman of the brass foundry of the Bethlehem Steel Works, South Bethlehem, Pa.

Obituary.

W. K. Wright, for many years plater for the O. B. North Company, New Haven, Conn., died on Jan. 13th.

Charles E. Bulkley, formerly president of the Whiting Mfg. Co., manufacturing silversmiths, died in Summerville, N. C., on Jan. 14th, aged 76 years. He was elected president of the company when it was first incorporated in 1866, and held that office until it was sold to the Silversmiths Company.

Charles Barber, the head of the firm of Charles Barber & Co., of Attleboro, Mass., the well known gold and silver refiners, died on Jan. 15th, after a prolonged illness. He was born in Exeter, R. I., in 1854 and was at one time connected with the firm of John Austin & Son, of Providence. Later he formed the partnership of Remington & Barber of Providence and which afterwards became Horace Remington & Sons.

Charles H. Morgan, president of the Morgan Construction Company of Worcester, Mass., manufacturers of rolling mill machinery, died on January 10th, at the age of 80. Mr. Morgan was well known in the brass and copper trade and installed many rolling mills for the continuous rolling of copper rods. He was the first to apply steel rolling methods to the copper mill and was instrumental in bringing the cost of production down to a basis that compared favorably with steel.

Albert M. Hill, who for many years conducted a brass foundry at 573 Dixwell Ave., New Haven, Conn., died on Jan. 19th, aged 84 years. He was one of the first in the United States to make nickel anodes and for years made them for the firm of Yates & Ely and afterwards for C. Upham Ely, who succeeded them. Mr. Ely afterwards bought out the foundry and has since conducted it. In addition to anodes, Mr. Hill manufactured German-silver knife tips, the smallest castings known in the foundry trade and was the only maker of them.

Current Metal and Supply Prices.

These Prices are net and are for moderate quantities. Smaller quantities command higher prices. Prices subject to fluctuation.

Acetone, pure, 98-99%	lb.	.22
Acid, Acetic, pure, 30%	lb.	.07
Acid, Arsenious (White Arsenic)	lb.	.20
Acid, Benzoic	lb.	.55
Acid, Boracic (Boric), pure	lb.	.12
Acid, Hydrochloric, see Acid, Muriatic.		
Acid, Hydrofluoric, 30%	lb.	.04
Acid, Hydrofluoric, 50%	lb.	.10
Acid, Muriatic, 20°	lb.	.02
Acid, Muriatic, c. p., 20°	lb.	.07
Acid, Nitric, 38°	lb.	.05⅝
Acid, Nitric, 40°	lb.	.05⅞
Acid, Nitric, 42°	lb.	.06¼
Acid, Nitric, c. p.	lb.	.08
Acid, Sulphuric, 66°	lb.	.01¾
Acid, Sulphuric, c. p.	lb.	.06
Alcohol, Wood	gal.	.50
Alcohol, Denatured	gal.	.55
Alum	lb.	.04
Ammonium Sulphate	lb.	.07
Aluminum, Metallic, in Ingots	lb.	.22
Aqua-Fortis, see Acid, Nitric.		
Ammonia Water (Aqua-Ammonia), 20°	lb.	.04¾
Ammonia Water (Aqua-Ammonia), 26°	lb.	.06¼
Ammonia Water, c. p.	lb.	.08
Ammonium Carbonate, lump	lb.	.15
Ammonium Chloride (Sal-Ammoniac)	lb.	.12
Ammonium Hydrosulphuret	lb.	.30
Ammonium Sulphate	lb.	.07
Ammonium Suphocyanate	lb.	.50
Amyl Acetate	gal.	1.85
Antimony	lb.	.08¼
Arsenic, Metallic	lb.	.15
Arsenic, White (Acid Arsenious)	lb.	.20
Argols, White (Cream of Tartar)	lb.	.31
Asphaltum, Commercial	lb.	.05
Asphaltum, Egyptian (Bitumen)	lb.	.30
Benzine	gal.	.15
Benzol, Pure	gal.	.75
Bismuth, Metallic	lb.	2.00
Bitumen, see Asphaltum.		
Blue-Vitriol, see Copper Sulphate.		
Borax, Crystals or Powdered	lb.	.10
Borax Glass	lb.	.35
Cadmium, Metallic	lb.	.70
Carbon Bisulphide	lb.	.10
Calcium Carbonate (Precipitated Chalk)	lb	.10
Chrome-Green	lb.	.50
Copper, Lake, (carload)	lb.	.12¾
Copper, Lake, (cask)	lb.	.13
Copper, Electrolytic, (carload)	lb.	.12½
Copper, Electrolytic, (cask)	lb.	.12¾
Copper, Casting, (carload)	lb.	.12¼
Copper, Casting, (cask)	lb.	.12½
Copper Acetate (Verdigris)	lb.	.35
Copper Carbonate, dry	lb.	.25
Copper Sulphate (Blue-Stone)	lb.	.09
Copperas, see Iron Sulphate.		
Corrosive Sublimate, see Mercury Bichloride.		
Cream-Tartar, see Potassium Bitartarate.		
Cryolite	lb.	.12
Cyanide, see Potassium Cyanide.		
Dextrin	lb.	.15
Emery Flour	lb.	.04
Emery, F F & F F F	lb.	.03
Flint, powdered	lb.	.01
Fluor-Spar	lb.	.01¼
Fusel-Oil	gal.	1.75
Gold Chloride	dwt.	.60
Gum Copal	lb.	.30
Gum Guiacum	lb.	.26
Gum Mastic	lb.	.70
Gum Sandarac	lb.	.35
Gum Shellac, brown	lb.	.50
Gum Shellac, white	lb.	.60
Iron Perchloride	lb.	.25
Iron Sulphate (Copperas)	lb.	.05
Lead Acetate (Sugar of Lead)	lb.	.15
Lead, Pig	lb.	.04½
Lead, Red	lb.	.12
Lead, Yellow Oxide (Litharge)	lb.	.12
Liver of Sulphur, see Potassium Sulphide.		
Manganese, Ferro, 80%	lb.	.10
Manganese, Metallic, pure	lb.	.75
Magnesium, Metallic	lb.	1.50
Mercury Bichloride (Corrosive Sublimate)	lb.	.93
Mercury, Metallic (Quicksilver)	lb.	.42
Mercury Nitrate	lb.	1.50
Mercury Oxide, yellow	lb.	1.80
Nickel and Ammonium Sulphate (Double Salts)	lb.	.16
Nickel Carbonate, dry	lb.	.60
Nickel Chloride	lb.	.50
Nickel Metallic	lb.	.47
Nickel Sulphate (Single Salts)	lb.	.25
Nitre (Saltpetre), see Potassium Nitrate.		
Oil of Vitriol, see Acid, Sulphuric.		
Paraffine	lb.	.15
Phosphorus, yellow	lb.	.40
Phosphorus, red	lb.	1.10
Pitch	lb.	.05
Plaster of Paris, Dental	bbl.	4.00
Platinum Chloride	oz.	20.00
Platinum Metallic	oz.	41.00
Potash-by-Alcohol, in sticks	lb.	.50
Potash, Caustic (Potassium Hydrate)	lb.	.08
Potassium Bichromate	lb.	.14
Potassium Bitartarate (Cream of Tartar)	lb.	.31
Potassium Carbonate (Pearlash)	lb.	.10
Potassium Chlorate	lb.	.15
Potassium Cyanide	lb.	.25
Potassium Iodide	lb.	2.25
Potassium Nitrate (Nitre or Saltpetre)	lb.	.10
Potassium Permanganate	lb.	.17
Potassium, Red Prussiate	lb.	.60
Potassium, Yellow Prussiate	lb.	.24
Potassium Sulphide (Liver of Sulphur)	lb.	.15
Potassium Sulphuret, see Potassium Sulphide.		
Potassium Sulphocyanate	lb.	.70
Pumice, Ground	lb.	.05
Quartz, Powdered	lb.	.01
Rosin, Yellow	lb.	.04
Sal-Ammoniac, see Ammonium Chloride.		
Sal-Soda, see Sodium Carbonate.		
Silver Chloride, dry	oz.	.75
Silver Cyanide	oz.	1.00
Silver, Fine	oz.	.52⅝
Silver Nitrate, crystals	oz.	.50
Soda-Ash	lb.	.05
Sodium Biborate, see Borax.		
Sodium Bisulphite	lb.	.15
Sodium Carbonate (Sal-Soda), crystals	lb.	.02
Sodium Hydrate (Caustic Soda)	lb.	.05
Sodium Hydrate (Caustic Soda) by Alcohol (in sticks)	lb.	.45
Sodium Hyposulphite ("Hypo")	lb.	.04
Sodium Metallic	lb.	.90
Sodium Nitrate	lb.	.05
Sodium Phosphate	lb.	.09
Sodium Silicate (Water-Glass)	lb.	.04
Soot, Calcined	lb.	.15
Spelter, see Zinc.		
Sugar of Lead, see Lead Acetate.		
Sulphur (Brimstone) in lump	lb.	.05
Tin Chloride	lb.	.43
Tin, Metallic	lb.	.41⅛
Turpentine, Venice	lb.	.35
Verdigris, see Copper Acetate.		
Water, Distilled	gal.	.15
Water-Glass, see Sodium Silicate.		
Wax, Beeswax, yellow	lb.	.45
Wax. Carnauba	lb.	.70
Whiting (Ground Chalk)	lb.	.02
Zinc Carbonate, dry	lb.	.19
Zinc Chloride	lb.	,12
Zinc, Sulphate	lb.	.06
Zinc, (spelter)	lb.	.05⅝

THE BRASS WORLD AND PLATERS' GUIDE

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A MONTHLY JOURNAL DEVOTED TO THE ART OF REFINING, ALLOYING, CASTING, ROLLING, FOUNDING AND ELECTRO-PLATING OF ALL THE NON-FERROUS METALS AND THEIR ALLOYS.

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Brick vs. Iron Stacks for Brass Foundries.

The cheapness of an iron stack and the rapidity with which it can be erected, have always made it attractive to brass foundries and the majority of establishments of this kind in the United States use them. While the first cost is very much less than a brick stack, and they can be made and erected in a short time, iron stacks are very much inferior to those of brick, both in the draft obtained and in their life.

In order to render the iron stack as light and as cheap as possible, it is made of comparatively thin gauge sheet. The iron soon rusts out or burns out and a new stack must be erected. In the use of an iron stack, many foundrymen, in order to economize as much as possible, run the flue from the furnaces directly into it without lining with fire-brick or building a brick base. This results in the rapid burning out of the bottom of the stack. To obtain the best results from an iron stack and to lengthen its life, a brick base should be built and the stack placed upon it. In this manner the brick bears the extreme heat. The base can be made of red brick, but should be lined with fire-brick.

A good brick stack is a very satisfactory thing. The question is frequently asked: Is a brick stack better than an iron one, and how high should it be? The answer is that a brick stack is much superior to an iron one and should be used whenever possible. As far as the height of the stack is concerned, it will depend upon conditions, but it cannot be too high. We have never heard of a brass

foundry having too much draft. For ordinary work 50 feet will do if there are but a few furnaces, but 75 or 100 feet are better for a good sized foundry.

There is one thing to bear in mind in building a brick stack, and that is that a cheap brick stack is an exceedingly poor investment as it will not stand the rain and wind. It should be built of good red brick and lined part of the way inside with fire-brick where the most heat comes.

Square stacks are cheaper to build than round ones and are generally used. It is a singular fact that practically all the brass rolling mills in the great brass region of Connecticut (the Naugatuck Valley) use brick stacks. Now and then an iron stack is seen, but it has been found from experience that the brick stack is the most economical.

A better draft will always be obtained from a brick stack than from an iron one. This is brought about by the radiation of the heat by the iron and thus cooling down the gases which pass through. In the case of the brick stack, the gases are not cooled and the brick when once heated remains warm, thus increasing the draft.

Effect of the Quality of Spelter on the Leakage of Valve Castings.

The leakage of valve castings when tested is one of the greatest difficulties encountered in the manufacture of steam metal goods. In the case of valve bodies it is not unusual to have from 15 to 25 per-cent of the castings show leakage when tested. This fact not only results in an increased cost, but brings in the factor of uncertainty which is always unsatisfactory in the matter of cost calculation.

While the majority of leakages in valve bodies are caused by pouring the metal too cold, there are other factors which enter into the question and one of them is the quality of the spelter that is used in making the valve mixture. New metal is almost invariably used by valve manufacturers in the manufacture of the valve bodies, while scrap is used in making the other parts. The bodies are the troublesome parts. The mixture for steam metal varies with each maker, but not to any great extent. It always contains from 3 to 5 per-cent of spelter. Without it, the casting would not be sound.

While the amount of spelter used in steam-metal is quite small, yet its quality is important. Any good, "virgin" spelter is perfectly satisfactory and the lead and iron in good commercial brands are so small that it has no influence on the metal. By "virgin" spelter is meant that which is made directly from the ores, and is not the result of remelting scrap. It is the remelted spelter that is apt to affect the steam-metal for the reason that it frequently contains *aluminum*.

In making remelted spelter from scrap zinc, zinc-dross and other materials, it is customary to add a certain amount of aluminum to it in order to reduce the oxide of zinc. While the amount of aluminum used is small, some remains in the spelter and finally enters the steam metal. "Virgin" spelter, of course, contains no aluminum.

To mention aluminum to a valve maker is like "shaking a red flag at a bull" as he well knows (often to his great financial loss) that even a few hundredths of a per-cent will cause the valves to leak when tested. It has been found in a number of instances that, while the valve manufacturer well knew the bad effect of aluminum in valve metals, he had been using spelter containing aluminum. This, of course, was done unconsciously and as soon as remedied the number of leakages became less.

Low brass is the term employed in the United States to designate sheet brass, rod, wire or tubing that contain the minimum amount of copper and yet have a yellow color. The standard mixture for "Low-Brass" is 4 parts of copper and 1 part of zinc (equals 80% of copper and 20% of zinc). It is used because of its softness. It has a green shade of color.

The first invoice for brass sheet rendered in the United States was made in 1827 to Ephraim Downs and was sold by Aaron Benedict of Waterbury, Conn., to him. The invoice called for 6 lbs. 13 oz. of button metal at 35 cents, and 68½ lbs. of sheet brass at 35 cents. Aaron Benedict was the founder of the Benedict & Burnham Mfg. Co., of Waterbury, Conn. The invoice was receipted by Israel Coe (for Aaron Benedict) who was afterwards the founder of the Coe Brass Mfg. Co., of Torrington, Conn.

The Hellberger Electric Transformer Crucible Furnace.

Although electric furnaces are now extensively used in the manufacture of steel, they have not made much headway in the treatment of the non-ferrous metals. To be sure, small furnaces of the resistance type are made for laboratory work, but they can scarcely be called a commercial proposition and are not used for melting anything but the smallest quantities of materials.

The furnace consists of two parts. The transformer is at the rear and is used for transforming the electric current. To control the melting, the furnace is provided with an ammeter and regulating switch, both of which may be seen in the various illustrations. They are placed at the top of the transforming apparatus. By the use of the regulating switch and the ammeter it is possible to completely

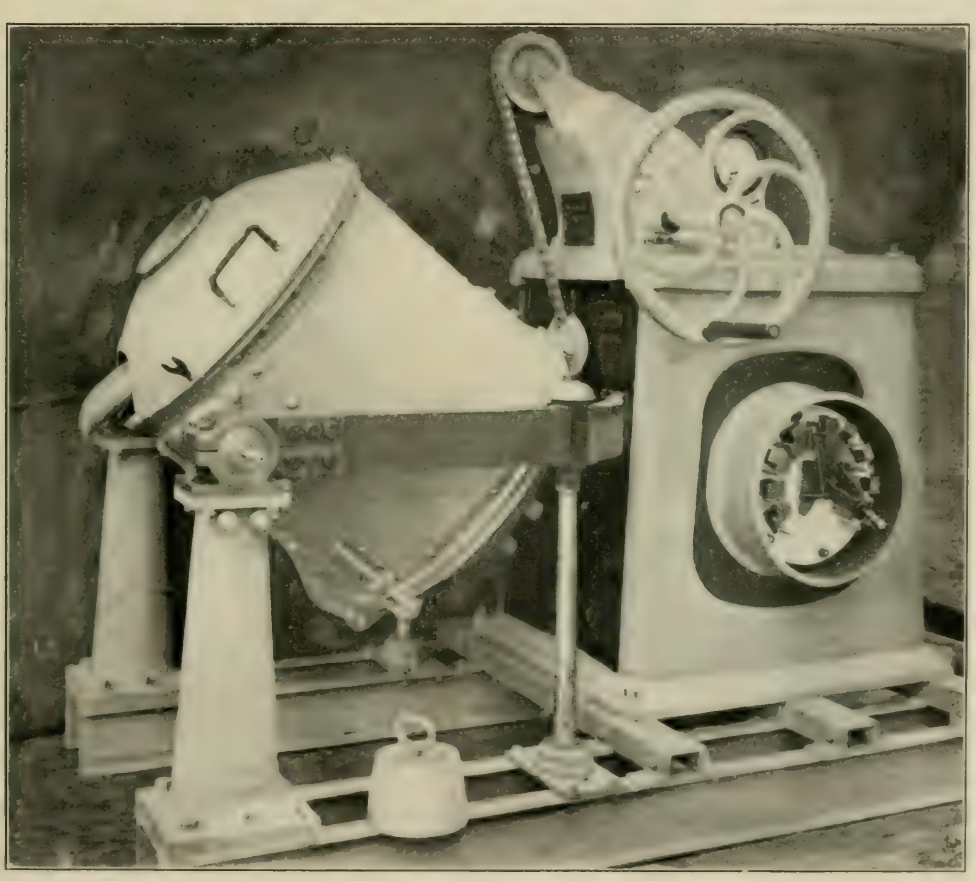

Fig. 1. Large "Hellberger" Tilting Electric Furnace for Crucible Melting.

There has recently appeared in Germany, a new and unique type of electric furnace for melting metals and which uses the ordinary graphite crucible. This furnace is known as the "Electric Transformer Furnace" and the construction may be understood by reference to the various illustrations which accompany this article.

regulate the heat of the molten metal so that there is no overheating effect.

The range of the furnace is wide, and it is possible to melt anything from soft metals up to platinum. In fact, quartz sand is readily melted in it so that it is adapted for all classes of work. The furnace is intended, the maker says, for melting brass, copper, silver, gold,

platinum, tin, lead, zinc, iron or steel; and also glass, enamel, etc. It is, therefore, adapted for all classes of work.

For melting, an ordinary graphite crucible is used, but it is treated with a special preparation supplied by the maker of the furnace before it can be used. The formula for this preparation is supplied with the furnace.

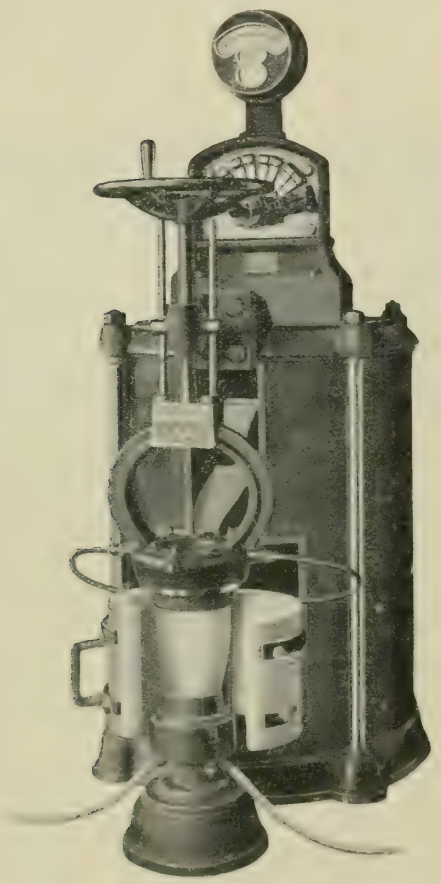

Fig. 2. Furnace Showing Method of Placing the Crucible.

The crucible is then placed upon a pedestal, which may be seen in Fig. 2, and the bottom of which is cooled by passing water through it. The pipes running from the pedestal are for supplying the water so that it will not become overheated during the melting. The crucible is surrounded with a ring or jacket of fire clay in order to prevent the loss of heat by radiation. This jacket is so constructed that it can be easily moved.

On the top of the crucible a connection plate is clamped by means of the screw and hand wheel device, and when this has been done, the whole is ready for melting. After the fire-clay jacket has been moved into position, the current is turned on by means of the regulating switch. At first a weak current only is used. The upper holding or clamping mechanism touches the crucible only at the edge so that the metal in it can always be observed and filling or stirring may be carried out when desired.

After the current has been on a few minutes, the crucible becomes red hot and the current is then increased so that the melting begins. All this takes place before the eyes of the melter and everything can be observed. There is no annoyance from heat radiation like that which follows in melting with ordinary furnaces. The exact moment can be noted when the melting is complete. Any additions may then be made to the crucible without changing its heat or in any way altering its position.

While small quantities may be melted in the furnace, the cost of melting is greatly reduced when larger amounts are treated. The cost for melting 200 lbs. will be found much less per lb. than in melting 50 lbs.

The cost of running the furnace is indicated by the following results obtained in the melting of copper:—

Copper Melted.

16.5	Kilos	melted	in	396	Kilowatt	minutes
18.5	"	"	"	420	"	"
15.5	"	"	"	376	"	"
20.0	"	"	"	450	"	"
19.5	"	"	"	468	"	"
20.0	"	"	"	364	"	"
20.0	"	"	"	408	"	"
130.0	"	"	"	2900	"	"

Figuring out the cost of melting, therefore, with electric current at 1 cent per kilowatt hour, the cost of melting 1 lb. of copper will be 0.17 cents per lb. As this is a low cost for current, the reader can easily figure his own cost from the cost of his own current.

In the melting of precious metals, the following results were obtained: 1 kilo of gold of 14K, required 30 kilowatt minutes. I kilo of platinum (pure) required 615 kilowatt minutes to melt it.

The furnaces are manufactured in sizes ranging in capacity from the melting of 1 lb. of copper to 250 lbs. In Fig. 1 is shown the

large size furnace arranged for tilting so that the metal can be easily poured.

Dr. Ludwig Weiss carried out some experiments with the furnace which are herewith given. He describes his experiments as follows:

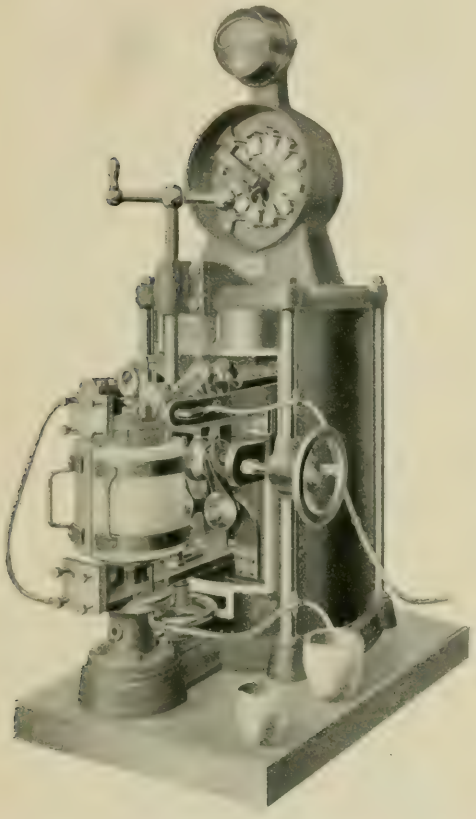

Fig. 3. Furnace with Fire-Clay Jacket in Place.

"I have been requested by Dr. A. Neuberger, to write a report for the Electrochemische Zeitung about the experiences which I had the opportunity of obtaining in experimenting with Hellberger's Munich transformer furnaces. I gladly do this in order to direct the attention of my colleagues to the excellence of the furnace.

During years of experiments in the laboratory, I and Prof. Muthmann have been occupied with testing all kinds of electric furnaces, and we have employed many kinds of make of furnace for the most varied objects. The furnaces in the trade frequently did not attain the desired temperature, or the vessel to be heated was too small, or the durability and simplicity of the furnaces, as well as the care necessary in operating them, left much to be desired. The Hellberger furnace offers so many advantages as compared with other constructions, that after searching experiments with it, I was quite enraptured with it.

The principle, upon which the furnace is made, is certainly not new. It is that of electrical resistance. But the pleasing and uncommon execution, the firm construction, the rapid and certain manner of working, also the circumstance that on working with the furnace one is not annoyed by heat, smoke or soot;

Fig. 4. Small Furnace Partly Tilted.

and can continually watch the melting process, are so apparent that the Hellberger furnace must be spoken of as the most perfect one up to the present time.

First the temperature measurements, which I took with a "Fery" pyrometer on two different large furnaces, showed that the prevailing temperature inside of the crucible was about 200-300 degrees higher than its outer side. This showed an essentially better utilization of

the heat conveyed. The crucibles were also better preserved than is the case of coal or coke as fuel. The crucibles used have therefore lasted much longer, and stand from three to five times the number of heats.

The rise in temperature takes place very rapidly. A common graphite crucible 8 cm. high was heated in 11 minutes to 1495 degrees C. upon employing first 40 and finally 100 amperes at 110 volts. A larger crucible 18 cm. in height, 2.5 cm. in thickness and 12 cm. inner width was heated for 33 minutes. At the beginning the current strength was 50 and finally 275 amperes at 92 volts. The temperature of the crucible rose:

In	3	minutes	to	1350	degrees C.
In	5	"	to	1730	" "
In	9	"	to	1840	" "
In	12	"	to	2020	" "
In	16	"	to	2080	" "
In	24	"	to	2190	" "
In	27	"	to	2260	" "
In	23	"	to	2360	" "

The rise in temperature was not ended with this. About 400 grams of the finest quartz sand were put into the crucible. In 5 minutes this had become soft, and in 8 minutes it could be drawn out into long filaments which agreed entirely with the so-called English quartz glass. What remained in the crucible had

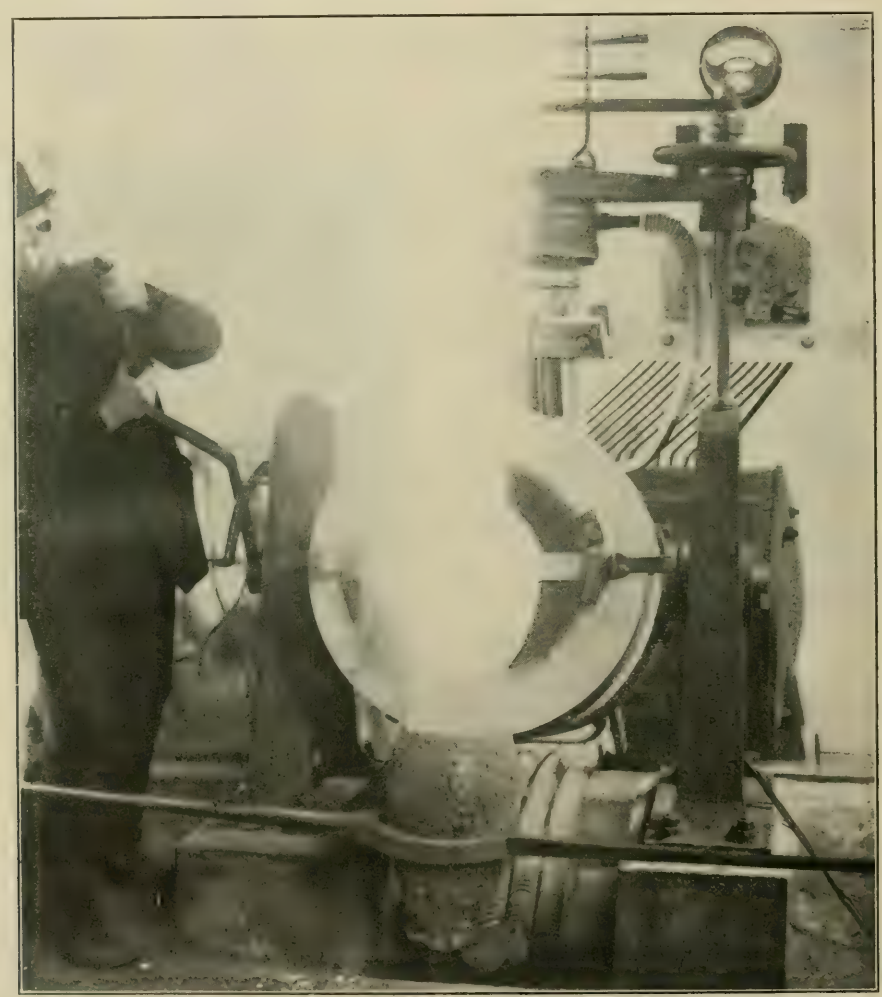

Fig. 5. Pouring the Melted Metal from the "Hellberger" Tilting Electric Furnace.

become almost transparent, in some places quite clear and without enclosing bubbles. The experiment had finally to be stopped as the crucible had suffered much waste.

To prevent the crucible from burning away, and to diminish the loss of heat from radiation, the carbon crucible, which again was 18 cm. high, was surrounded with a jacket of fire clay, and the intervening space filled with quartz powder; the outer fire clay case was finally made as air tight as possible with asbestus and fire-clay mortar. Under these circumstances a much higher temperature was reached than before.

After	8	min.	temp.	1000°	90	Amp.	104 Volts.
"	10	"	"	1200°	140	"	103 "
"	15	"	"	1470°	160	"	101 "
"	20	"	"	1760°	160	"	101 "
"	25	"	"	2150°	165	"	100 "
"	32	"	"	2220°	170	"	99 "
"	35	"	"	2510°	235	"	95 "
"	40	"	"	2670°	242	"	94 "
"	45	"	"	2715°	248	"	93 "

The last temperature measurement is too low, as the pointer of the millivoltmeter employed rose over the scale. Now a series resistance of 71 Ohm was inserted into the circuit, on which the voltage shown on the millivoltmeter went back to approximately one half of the former amount. For some time longer a rise of temperature could be ascertained, if it was not measured. I believe that at the end, with 290 Amp., and 88 Volt, the temperature attained rose to over 3000 degrees.

Quartz was then put into the crucible. After a short time filaments of melted quartz could be drawn out of the crucible. Finally, the whole contents of the crucible were taken out and moulded between previously heated steel plates in a press to a disc about 1 cm. thick and 10 cm. broad. The quartz had in some places become quite as clear as water. After finishing the experiment (after 3 hours) the crucible showed only quite a small wasting; the exterior insulating bed of quartz was on the contrary completely melted away.

Further experiments in this direction, as to the use of suitable insulating material, are still in progress.

Melting silver, copper, or gold, of course, creates not the least difficulty; 1 kilo copper could be quite melted in 4 minutes, to which it should be noted that the graphite crucible used was put into the furnace in a cold state. Steel, and wrought iron, also nickel could be rendered quite fluid in a very short time, and cast. It is remarkable that the melting of metals can be carried out almost without any waste, as, in consequence of the easy regulating of the furnace and the ready observation of the melting process, overheating can be completely cut out. As temperatures of far over 2000 degrees are easily reached, it goes without saying that platinum and metals difficult to melt can be melted. Glass, enamel, etc., can, in graphite crucibles which are covered with fire clay, be directly melted from their ingredients.

The small working expenses, the possibility of working a larger number of furnaces parallel and independent of each other, the easy putting in and filling the crucibles, the possibility of watching the melting continually, of making additions, the rapidity of the work, the great safety in working, and durability of the Hellberger furnaces, will secure them a large scope of use both in the laboratory and the technic. Besides the objects mentioned above, they might be introduced into brass and bronze foundries, into smaller iron and steel foundries, for melting platinum and iridium, in the ceramic and glass industries. The freedom from smoke and soot, and the independence of chimneys, allow them to be put up in most places.

The furnaces in the various sizes herewith shown are manufactured by Hugo Hellberger, Munich, 41, Germany.

Although cadmium is present in many grades of commercial spelter, it has no appreciable effect on brass made from it.

Lard oil is now the standard material for use in coating the cast iron molds used for casting brass for rolling. It should be of the best grade and free from mineral or vegetable oils. Fish oil was used for many years, but the smell is objectionable. It gives equally as good results, however, as the lard oil.

Metals should not be melted too rapidly or certain portions of them will become overheated before the rest arrive at the melting temperature. The best condition is when all of the metal arrives at the melting point at practically the same time. This is difficult to realize in practice, but should be attempted.

Amyl Acetate and its Value in Lacquer Manufacture.

Before the discovery of the so-called "cold-process" lacquers, or those which are used without warming the metal to which they are applied, the only lacquers known were those made by dissolving a gum in alcohol. Gum-shellac was the principal material used for this purpose. On account of the fact that alcohol absorbs water readily, the work to be lacquered with a spirit lacquer of this kind, must be warmed, otherwise any absorption of moisture will cause the lacquer to turn white. A spirit lacquer of this kind, however, is an excellent material when well applied, and as the work is warmed, it is possible to apply a number of coats so that an exceptionally durable lacquer is obtained. In England, the spirit lacquers are still largely employed. They are also used for lacquering brass bedsteads.

The fact that the spirit lacquers must be applied to the work while it is warm renders the lacquering process costly. Not only must the lacquer be applied with a brush, but a much higher grade of labor is necessary than in the use of the "cold process" lacquers. For this reason, the spirit lacquers have been supplanted almost entirely in the United States by the pyroxylin (soluble cotton) lacquers which are used cold. These lacquers, in addition to the fact that they can be applied cold, are very tough and durable.

In making the "cold process" lacquers, the pyroxylin (soluble cotton or nitro-cellulose) is dissolved in amyl acetate, and it is the use of this solvent that, to a great degree, has brought about their success. While a large number of solvents for the pyroxylin are known, many of them are too expensive to be used, and others have the property of absorbing water when exposed to the air. When such solvents are used, lacquer containing them is no better than the spirit lacquers for the reason that it is liable to turn white during the lacquering operation. Amyl acetate, however, is a water *repellent* or in other words, it does not absorb water. Its use, therefore makes it possible to apply the lacquer cold without danger of its turning white. Were another solvent, such as acetone, employed, the fact that it absorbs water when exposed to the air would be apt to cause the lacquer to turn white during the application. It is the *water repellent* properties, therefore, that render amyl acetate so valuable as a solvent for pyroxylin in the manufacture of lacquers.

Amyl acetate is what is known chemically as an organic, aromatic ether. It has the odor of bananas and is frequently called "banana oil." It is made from fusel-oil, a mixture of various alcohols but principally amyl alcohol. By distilling fusel-oil and acetate of lime with an acid, amyl acetate is produced.

Amyl acetate is the best solvent for pyroxylin known and is very extensively employed in the manufacture of lacquers. As a usual rule, lacquer is not made by the simple solution of the pyroxylin in amyl acetate as it has been found better, for many purposes, to use other liquids with it. In a treatise* on pyroxylin etc., as applied to explosives, the following comment on the use of amyl acetate as a solvent in the manufacture of lacquer is made:

"Richard Hale uses the following solvent:

Amyl Acetate	4 volumes
Petroleum Naptha	4 volumes
Methyl Alcohol	2 volumes
Pyroxylin	4 to 5 oz.

to the gallon of solvent.

Hale used petroleum naptha to hasten the drying qualities of the lacquer, so that it would set on the article to be lacquered before it had a chance to run off. It is, however, the non-hygroscopic (water repellent) character of the solvent that makes the lacquer successful. This formula is very largely used for the production of pyroxylin lacquer, which is used for lacquering pens, pencils, etc., and also for brass work and silverware."

The presence of a small amount of copper in a nickel plating solution will darken the nickel deposit.

It is believed that cyanide of silver gives a better silver plating solution than the chloride of silver. Owing to the difficulty in making it, it is not as extensively employed as the chloride. The relative value of each, however, has never been determined.

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*Nitro-Explosives, by P. Gerald Sanford.

Salt Water Gilding and the Method of Accomplishing It.

Although salt water gilding is one of the oldest methods of electroplating, the method of carrying it out is not widely understood. Early used, it was replaced to a large extent, by the other gilding methods employing the current and for many years was not a favorite operation. For the past five years, however, it seems to have come back and now the demand for knowledge of the process seems greater than ever. The simplicity of the process and the fine character of the results have been the means of bringing this about.

deposits the gold, although in the salt water gilding it is generated in the apparatus itself.

The method of generating an electric current by means of a salt solution in conjunction with copper and zinc was one of the things known when the electric battery was first discovered, but the application of it belongs to Achille Berthoud of New York City, who was granted a patent upon the process in 1860 (U. S. Patent No. 30,663, Nov. 20, 1860). The address of the patentee was given as 214 William St., New York City, but whether

Fig. 1. The Apparatus for Salt Water Gilding Set Up with Steam and Drip Pipes, Ready for Use.

It is an open question whether results equal to those of the regular process are obtained in salt water gilding, but it is believed that when the conditions are equal that equal results can be obtained. There is no reason why they should not, as in each case the electric current

he is still living is doubtful. To him seems to belong the credit for discovering the process and as carried out by him it remains practically unchanged to-day.

As carried on, salt water gilding consists in electroplating articles with gold, but no elec-

tric current is used except that generated in the apparatus itself. As far as current consumption is concerned it is very economical. The apparatus necessary consists of three pieces only. These may be seen in Fig. 3. They are as follows:

A copper tank or kettle. This is made of sheet copper and as the gilding is carried on hot it is preferable to have the kettle steam jacketed. The kettle shown in Fig. 3 is of this kind and the method of doing it may be understood by referring to Fig. 2. The drip or exhaust pipe is at the bottom and may be used, if desired as a support for the kettle. The steam jacketing is not absolutely necessary, although for large solutions and regular work it will be found very satisfactory. Any other convenient shape of copper tank or kettle may be used and can be heated by a coil of pipe through which steam is passed. Small receptacles can be heated by a sand bath. The operator will usually find some way to carry out the heating.

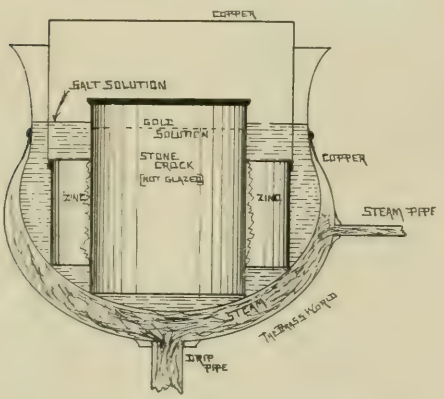


Fig. 2. Sketch Showing Arrangement of the Apparatus.

The vessel used for holding the gold solution is shown in the middle of Fig. 3. It is a clay stone-crock, *but is not glazed.* If glazed, the plating will not take place. These unglazed crocks may be purchased.

The third article is a ring of sheet or cast zinc and is shown at the right of Fig. 3. To it a bail or handle of copper is fastened by riveting. The zinc ring should be of good thickness and it is customary to use about 1-4 in. zinc although thicker is all right and thinner material will answer for quite a time. The zinc, however, is gradually dissolved.

When the apparatus is used, the zinc ring is placed in the copper kettle on the bottom so that it touches and the stone crock is set inside of it. In Fig. 1 is shown the apparatus already set up with steam pipe and method of hanging the work in the solution.

Gilding Solution Used.

It is not customary to employ the regular cyanide gilding solution in the salt water process, but one containing yellow prussiate of potassium. The formula patented by Berthoud is a good one and gives a bright deposit of good color. It may be modified by the addition of silver or copper solution as afterwards described. The solution is made as follows:

Water	1	gallon
Yellow Prussiate of Potassium	4	oz.
Phosphate of Sodium	2	oz.
Carbonate of Potassium	1½	oz.
Sulphite of Sodium (neutral)	1	oz.
Gold	2	dwt.

The gold is dissolved in aqua-regia, evaporated to a syrup and then converted into the fulminate by precipitation with ammonia. It is filtered without delay and washed several times and then *without drying* is added to the solution of the other ingredients.

The solution, after the fulminate of gold has been added, is boiled for half an hour and water added to make up for the evaporation. When the boiling has taken this length of time, a red precipitate or iron hydroxide will have separated out. If the solution is used without boiling and this is allowed to separate, the deposit of gold will not be good. Filter out this iron and the solution is ready for use.

Using the Apparatus.

To use the apparatus, the copper kettle is filled with a saturated solution of common salt, that has dissolved in water all the salt it will take up. Pour this in the space between the stone crock and the kettle. The gold solution is poured in the stone crock. The level of the two solutions should be the same. The steam is passed into the jacket so that the whole is heated and then the plating can be commenced. The article to be plated is simply hung in the solution from the copper bail or yoke over the crock and connecting the zinc. As the time required for gilding is only a few seconds, it is necessary simply to hold the

article with the wire touching the copper. The gold begins to cover the surface and in a few seconds the whole surface is gilded.

The article will be found evenly gilded. This is apparently brought about by the fact that the zinc is situated all around the stone crock and an even current is set up. The current generated is feeble but is quite sufficient for the purpose. The value of the salt water process lies in the fact that the current is always the same and there is no chance of burning the deposit. The process could scarcely be simpler.

and filter. This solution is added in small quantities at a time to the gold solution until the right color has been obtained.

In case copper is to be added to alter the shade of the gold then use the same solution as that for silver except instead of the silver employ 10 dwts. of copper. Dissolve in nitric acid, add water and precipitate hot by means of yellow prussiate of potassium. Then filter out, wash and add to the solution. This copper solution is added a little at a time to the gold solution until the right color has been obtained.

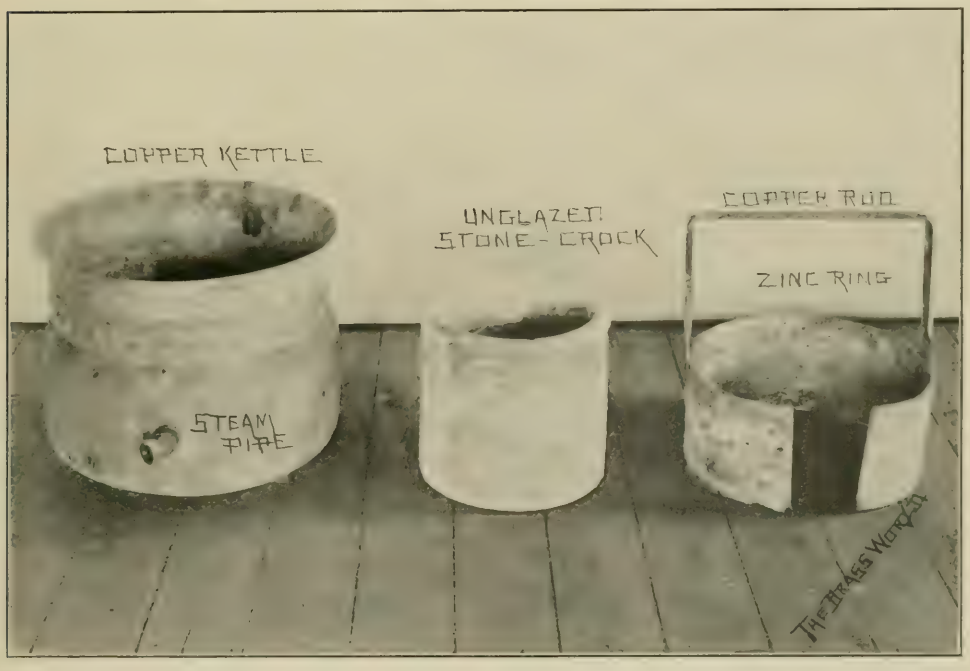


Fig. 3. The Three Parts of the Salt Water Gilding Apparatus.

In case silver is to be added to the solution to alter the shade of the gold, chloride of silver is dissolved in a solution made up as previously described but containing no gold. This is made up as follows:

Water	1	gallon
Yellow Prussiate of Potassium	4	oz.
Phosphate of Sodium	2	oz.
Carbonate of Potassium	1½	oz.
Sulphite of Sodium	1	oz.
Silver	10	dwts

Convert the silver into chloride and then dissolve in the solution, boil for half an hour

The temperature of the solution, when the gilding is being done, can be regulated to suit the color, but it is usually kept at about from 120 to 150 degrees F. As the water evaporates both from the salt solution and the gold bath, more is added to keep up a normal condition. When the solution needs gold, more fulminate of gold is added as it simply replaces that which has been deposited and does not affect the solution. It must be borne in mind that the fulminate of gold produced by precipitating the gold by ammonia is explosive when dry. When wet, however, it is harmless.

A New Method of Making Asbestus Molds.

A new method of making asbestus molds for casting gold, silver, bronze and other metals has been patented by G. H. Brabrook of Taunton, Mass. (U. S. Patent 984,469, Feb. 14, 1911), formerly general manager of the Reed & Barton Company of that city. In the process, sheet asbestus is employed in the following manner as described by him:

"In manufacturing the molds I take a sheet of moist asbestus of the desired thickness and place it upon the pattern and ram or pack in the interstices of the said pattern with a stereotyper's brush or similar tool, until the perfect mold is obtained, after which the mold is removed from the pattern, or if more convenient, the mold may be partially dried upon the pattern under pressure. I then apply to the surface of the mold a facing material of some suitable kind and replace the mold upon the pattern and ram it again, thereby causing the facing material to take the impression of the pattern, so that the mold is left with a smooth, almost polished, surface which is free from disturbed fibers and unevennesses.

"The asbestus which I use is preferably the ordinary asbestus paper of commerce and which I believe to be made of asbestus fiber held together with sizing or paste or other suitable binding material and having also possibly a filling of clay or similar material. I do not, however, consider the presence of the binding or filling material as essential since I believe the asbestus fiber alone might be used. When asbestus fiber is employed, it is formed into a moist mass or pulp and a layer of sufficient thickness is applied to the pattern under pressure. I take a number of these sheets and moisten them and paste the proper number of sheets togethr to form a mass of any desired thickness.

"The application of the facing material to the asbestus mass may be made before the mass is placed upon the pattern and rammed if preferred. In practice I find it best to use the facing material in the manner described in my application for process of molding, filed November 9, 1904, Serial No. 232,059. In the process there described I apply a facing composed of some suitable incombustible and non-fusing facing material such as German or French burnt sand in the form of an impalpable powder and capable of withstanding a high degree of heat mixed with a volatile liquid hydrocarbon, preferably benzine, non-mixable with water. The said facing material and volatile liquid are preferably mixed together in the proportions of one-third of a pint of the facing material to one pint of the liquid, and this mixture is then sprayed or otherwise applied to the surface of the asbestus in a thin paste or semi-plastic condition, so as to fill in the interstices of the surface of the mold and form a skin or layer on said surface. The benzine may be modified to cause it to evaporate more slowly, or it may be, if desired, rendered non-inflammable by the mixture of a proper proportion of tetra-chlorid of carbon. After the facing material has been applied to the asbestus mass, the said mass is placed upon the pattern and rammed after which the asbestus mold thus obtained is dried or baked.

"In the case of very deep ornamentation, the following method of applying the facing material may be employed. First, face the asbestus, then ram on the pattern and should the high and deep points break through the facing, a further application of the facing material may be made and another ramming on the pattern effected.

"I am aware that it has been hitherto proposed to face asbestus stereotype matrices with plant glue. Such a mold will not, however, answer the purposes for which my mold is intended since the facing would not withstand any considerable degree of heat and would, therefore, be wholly unfit for the casting of metals commonly employed in the production of high grade castings having fine ornamentation thereon. The facing material which I employ is a powder characterized generally as infusible and incombustible. I do not, however, wish to limit myself to the use of any particular infusible and incombustible powdered facing material."

Oil is not free from sulphur and this must be taken into consideration in melting metals. Pennsylvania oils do not contain as much as the Texas ones. Samples of Pennsylvania products showed from 0.19% to 0.63% of sulphur, while the Texas oils contained as high as 4.98%.

The Use of Storage Batteries for Electroplating.*

By Geo. M. Howard.†

The electroplater utilizes a current of electricity to bring about certain chemical or electrochemical reactions, which consist in the dissolving of metal from the anode and the depositing of the same metal upon the cathode. In any battery, primary or secondary, the action is the reverse of this. The chemical reactions taking place between the electrolyte and the two electrodes respectively cause a difference of electrical potential between the poles, so that when these are connected by a metallic circuit outside of the solution a current of electricity will flow. In a plating bath the anode, or positive pole, is made of the metal to be deposited, and the solution must be so constituted that the anode will dissolve in it only under the action of the current, thus replacing the metal deposited and keeping the bath constant. Practically all primary batteries have this in common with the plating bath, that one of the electrodes goes into solution. An illustration of this is the zinc in an ordinary Leclanche' or gravity cell. A primary cell when exhausted cannot be restored except by the replacing of the exhausted element—either the solution, or one of the electrodes, as the case may be. To restore a secondary or storage cell, however, it is only necessary to pass through it a current from some outside source in the reverse direction to that given by the cell. One of the chief requisites for this characteristic of reversibility is the comparative insolubility of both electrodes in the solution under all conditions of charge and discharge, and it is in this respect particularly that the storage cell differs from both the primary cell and the plating bath.

The active elements of a lead storage cell are peroxide of lead for the positive plate and spongy metallic lead for the negative in an electrolyte of dilute sulphuric acid. The "active materials" have to be supported, and the plates are therefore either constructed with grids, which hold the material in place, or else are made with a sufficient core of solid lead to give the necessary strength.

*An Address made at the Banquet of the National Electroplaters' Association, held at the Hotel Marlborough, New York City, on Feb. 11th.

†Chief Chemist, The Electric Storage Battery Co., Philadelphia, Pa.

Upon discharge, a portion of the lead peroxide and spongy lead unite with sulphuric acid from the electrolyte forming lead sulphate on both plates. The lead sulphate being practically insoluble, remains on the plates, and is very readily brought back to peroxide and metallic lead respectively upon charging. Thus it has been seen that the "storing" consists merely in bringing about certain chemical reactions by means of an electric current, and that the reverse reactions taking place on discharge produce the secondary current.

The voltage of the lead storage battery on discharging is considerably higher than that of other cells, either primary or secondary, averaging close to two volts at moderate rates. On the other hand the very low internal resistance makes it possible to draw very large currents if desired.

Coming now to the application to plating, everyone who has had experience knows how important it is to maintain a constant current in order to secure uniform deposits. Low voltage dynamos, whether shaft or motor driven, are subject to considerable fluctuations. The steady voltage of the lead battery makes it peculiarly suited to maintaining a constant current. When batteries are used, not only will the deposit be more uniform than with machine plating, but it becomes possible to regulate the depth of deposit much more accurately by the ampere hours used. An instance of the value of the latter feature is found in the experience of a company doing a very large amount of silver plating. When doing their work from generators there was always an excess of silver deposited owing to the impossibility of accurately controlling the current. They installed large storage batteries, and the one item of cutting down the overweight saved enough money to pay for the battery in a year and a half.

In figuring on the proper capacity of battery to install it is advisable to allow a considerable margin. This is not only for the purpose of having a reserve, but also on account of the voltage characteristic. When a fully charged cell is put into discharge the voltage starts considerably above two volts and falls almost immediately to about two volts where it holds nearly constant until towards the end of the discharge, when it begins to fall more rapidly. Thus it is seen that there is a flat portion of the discharge curve where the voltage is quite constant, and in order to get the full benefit

of this in steady output without regulation, it is necessary to use batteries of such capacity that they will never be fully discharged.

There are two systems by which storage batteries can be used to advantage. The first is to use them as a regulator for the dynamos, and the auxiliary, so as to permit of twenty-four working without running the machine constantly. In this system during the day the battery is connected across the line from the generator to the plating circuits, taking current until it is charged, and then merely "floating," as it is called. While floating the battery is alternately charging and discharging for short periods as the voltage of the generator varies, and takes the fluctuations which would otherwise affect the working circuits. It is also valuable as a reserve, preventing interruptions in the work in case of a shut down of the machine for any cause. When the system described above is used it is necessary at intervals of once every two weeks to raise the voltage of the generator and give the battery what is called an "overcharge."

The second method, which is unquestionably better, is to have two batteries used alternately, one charging while the other is discharging, and do all the plating from the batteries alone, using the generator only for charging. This gives all the advantages derived from the constant current and the ability to run uninterruptedly as well.

The scope of this paper will hardly permit my going into the subject of care and operation at any length, but I should like to make a few remarks along that line. It is a well known psychological principle that idleness begets laziness—that the less a man has to do the more unwilling is he to do anything at all; and from this characteristic of human nature the storage battery suffers. The fact that it requires so little attention is apt to create a feeling that it requires none whatever. This feeling is fostered by the fact that a battery will continue for some time to work satisfactorily under abuse or neglect without showing signs of trouble to a casual observer; but the damage is being done all the same, and in the end the penalty must be paid. Almost any kind of machinery will give danger signals—there will be a squeak or a knock or some other warning. Not so with a battery. The warning is there, but it must be looked for, and will not obtrude itself upon your notice. Hence the necessity for systematic inspection and careful operation. It is really surprising how little attention is necessary provided only that it be systematic. I have often heard one of the pioneers in storage battery work say that if men were only willing to give one-tenth of the attention to their batteries that they give without question to engines, for instance, there would be an end of battery trouble. There is, perhaps, no case where the old adage, "an ounce of prevention is worth a pound of cure" more aptly applies.

The leading battery manufacturers publish instruction books giving full details for care and operation, and in addition maintain a corps of trained inspectors who are at customers' service without charge for advice and assistance.

The cardinal principles of operation may be briefly summarized as follows:

Do not allow the battery to discharge below the safe limit. This will be about 1.8 volts per cell at the low rates usually employed in plating work. If the battery has been proportioned to the work as recommended above, this warning becomes unnecessary.

As far as possible maintain a regular schedule for changing the battery.

Do not overcharge excessively. Add pure water to the cells often enough to prevent the plates from being uncovered by evaporation. The best time to add water is just before an overcharge, so that the gassing will cause it to mix with the electrolyte. Carefully inspect all cells at least once in two weeks, preferably just before the overcharge.

Remove sediment from the jars when within one-half of an inch of the plates. Have good ventilation during charge, and never bring an exposed flame near a charging battery. Never allow metals or impurities of any kind to get into the cells.

In conversation with men of wide general information but not conversant with storage battery practice I have been impressed with the prevalence of very vague ideas on the subject. It seemed to me therefore that it might be of some interest to give a few facts illustrating the diversified uses to which storage batteries are put and the magnitude of some of the installations. Most people are now familiar with their use for running electric automobiles and for ignition and lighting on gas cars; but few realize the extent to which they are used in large work, as for instance by the public service corporations. To take a local illustration, the New York Edison Company, which furnishes most of the

electric lighting in this city, has no less than forty-four storage battery installations having a total capacity of 33,000,000 ampere hours at the eight hour discharge rate. In Brooklyn there are eleven of these large lighting batteries. Large office buildings and hotels which have their own lighting plants nearly always include a battery as part of their equipment.

Many trolley lines use batteries as a regulator for their load, and as a reserve to help out the generators at times of heavy traffic.

The New York Central R. R. in connection with their suburban electrification have very large batteries installed.

The large steel companies are now adopting them for regulating the load in their works, the model plant at Gary, Ind., having a very large installation.

Coming to some of the smaller applications, the telegraph and telephone companies use storage batteries almost exclusively in their work. Nearly all of the new railway coaches are electrically lighted by means of storage batteries, and none but electrically lighted cars are permitted to run through the new Pennsylvania Tunnels on account of the danger from fire with other systems. The electric locomotives which haul these tunnel trains are controlled by means of storage batteries.

The modern railway signal systems are largely operated by storage batteries, one road alone having upwards of 30,000 cells in use for this purpose.

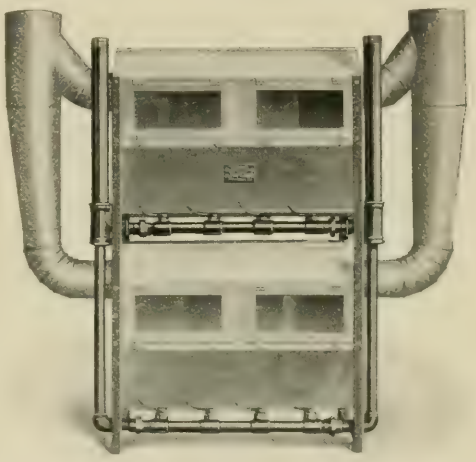
A comparatively recent application in which the separate plants are small, but which is growing to very large proportions in the aggregate, is for small isolated lighting plants, in conjunction with a gas engine and dynamo. Since the introduction of the low voltage tungsten lamps, with their small energy consumption, such a plant can be installed for so moderate an outlay that even many of the small farmers are able to enjoy the well known advantages of electric lighting.

In closing I would urge those of you who are not using storage batteries for your plating to study the benefits to be derived from their use, and I feel sure you will be amply repaid. The fact of your work being done at so low a voltage and with comparatively low current rates makes the investment necessary usually a small item—a consideration which should make the proposition all the more attractive.

A New Form of Sand Blast for Treating Sheet Metal.

A new form of sand-blast for removing the scale from wire or flat steel, as well as sand-blasting all other metals in such form, has been placed on the market by H. J. Astle & Co., 118 Orange St., Providence, R. I. The machine is herewith illustrated.

The body is made of heavy galvanized sheet steel and has glass doors so that the discharge of the sand upon the material passing through may be watched. The wire or sheet metal to be sand-blasted is placed on a reel from which



The New "Boland" Sand-Blast.

it passes through the lower part of the sand blast. The sand is then forced upon it through tubes by a pressure blower. One side of the wire or sheet is finished in this operation. It then passes out over flanged pulleys and enters the upper part of the apparatus where the sand blast finishes the other side.

The surface of the wire or sheet is thus finished by sand-blasting, and all scale removed. It is then ready for any further treatment which may be necessary and is wound on a reel as it issues from the top part of the apparatus.

Sulphur, when heated with gold, has no action upon it, but the reverse is true of silver. Sulphur attacks silver energetically and forms the sulphide of silver. Gold and silver may be separated in this manner, and the process was in use during the last century at the Mint in St. Petersburgh, Russia.

Looking Backward in the Plating Industry.*

By Erwin S. Sperry.

The very early history of electroplating is not particularly interesting. We know that thousands of years ago the Egyptians used mercury in the gilding of bronze statutes. It was the inception of the present "fire-gilding" process. We know that in 1799, Volta made his first continuous battery and that in 1805, Brugnatelli first gilded silver medals by means of it. It may be of interest to know that he used the fulminate of gold for this purpose.

No further application seems to have been made until the year 1839 when C. J. Jordan, an Englishman, discovered that by the use of a battery of suitable kind (and I will state that since their discovery by Volta in 1899, batteries had undergone much improvement) it was possible to deposit copper from a solution of sulphate of copper, upon wax previously coated with graphite. He used the process for making impressions of engraved copper plates and thus electrotyping was born. It is believed that Jordan's process was the first actual commercial application of electroplating. It was one of the remarkable discoveries of the day and hundreds of persons were engaged in experimenting with it. The field seemed enormous, many indirect applications were made, and the discovery greatly stimulated the art of electroplating, for soon afterwards silver plating made its appearance in the commercial world. Strange to say electrotyping is still carried on in the same manner, wax is used, graphite forms the conducting material and the copper is deposited in a solution of sulphate of copper. With a few refinements, the process remains unchanged.

We are now passing to the period of successful application of the art of electroplating and G. R. and H. Elkington, the famous English pioneers in this line, were engaged in the gold plating of military ornaments by dipping, the solution for which was patented by them previously. Up to this time, all plating had either been done by dipping, or by the well known method of close-plating which is nothing more than soldering silver or gold upon the base metal.

In 1840 these gentlemen were granted the first patent for electrodepositing silver, and it is this patent (granted in England on March 25th, 1840, No. 8447) that is the foundation and real beginning of our present art. It is now some 70 years since the patent was granted, and it will have to be admitted that little change has taken place since then. The Elkingtons used a cyanide solution like that now employed. Dynamos have replaced batteries, but further than this little can be said.

Silver plating, then, was first carried out in England and some seven years afterwards it seems to have been commenced in our own country when a company in Meriden began to manufacture silver plated goods. As far as known, it was there that electroplating was first commenced in the United States.

Let us see what has been done in this line since 1840.

Before the advent of silver plating, large quantities of pewter and britannia-metal were used. Steel knives and forks constituted the flat-ware, and those who could not afford the luxury of sterling silver spoons, used tinned iron ones. Pewter spoons were also made in large quantities. When silver plating proved successful, it was quite natural that it should be used upon the pewter or britannia-metal as these articles were comparatively expensive. German-silver had not come into extensive use at that time.

Although silver plating is a simple operation, its production was beset with difficulties when attempts were made to carry it out commercially. To perform an operation in an experimental way is one thing. To do it commercially is another.

The first obstacle in silver plating was the cyanide. Up to this time there was no use at all for it. It was not a commercial article and the only way was to make it. The making of cyanide was then as much a part of the plater's business as the making of the solution, and the majority of the platers who have passed the three-score mark will remember that this was so. It was only the other day that I made the acquaintance of a man of this kind who had worked in Sheffield during the early manufacture of silver plated ware, and he invariably made his own cyanide at that time.

Cyanide was then made by heating yellow prussiate of potash and carbonate of potash in

*An Address made at the Banquet of the National Electroplaters' Association, held at the Hotel Marlborough, New York City, Feb. 11th.

an iron pot. Demand soon created a supply, though, and cyanide soon became a commercial product. The old, dark gray product, however, with its low cyanogen content is a thing of the past and platers should consider themselves fortunate in obtaining the high grade product now manufactured.

When the first attempts were made to silver plate copper, brass or similar metals, it was found that the metal became coated with silver by simple immersion before the current began to pass. The deposit then peeled off when burnished. The discovery was soon made, however, that by cutting down the amount of silver in the solution, it did not deposit any metal until the current was passed through the solution, and that the deposit was adherent. The color of the silver was yellow and it was not particularly soft. Then somebody discovered that the way to carry on the process was first to give the article to be plated a light coating in this solution low in silver and high in cyanide, and then to deposit the regular coating in a solution rich in silver. In this manner the "striking solution" was evolved. The use of this solution marked an epoch in silver plating history, but it all took place before the present generation.

A reduction in the price of nickel caused a change to come over the silver plating industry. To my recollection it was soon after the Franco-Prussian War that this change came. Certain incidents in connection with the war were fresh in my memory when one day my father returned from Taunton, Mass., and brought some German-silver forks back with him that had been silver plated. By associating it with the war, it is still fresh in my memory. It may have been earlier than this that German-silver began to be used in making flat ware, but it was some time after the close of the Civil War.

The use of German-silver for flat ware undoubtedly did not originate in this country, but its manufacture has been developed by the Americans in a remarkable degree. It was the Yankees who brought out the machinery for making flat-ware upon a modern scale, and it has been through the agency of their machinery that foreign countries have been able to compete with us. The old method of making spoons and forks from a rod or as steel flat ware would be made did not appeal to the Connecticut Yankee, and by his ingenuity and skill, the present machinery for making them from sheet metal by blanking, grading and forming under a drop press has been perfected. I believe that I am right in claiming that the United States are the pioneers in flat-ware manufacture. In the silver plating we followed, but in the manufacture of the spoons and forks themselves we have revolutionized.

The advent of German-silver flat ware brought about unforeseen difficulties in the way of silver plating. It was found difficult to make the silver adhere and it would persist in stripping when burnished. Science then

First Article of "Royal-Copper" Produced in the United States. The Flowers Were Nickel Plated.

came to the rescue in the use of the "quick or blue dip." While it had been used long before in the fire gilding of metals, it was not considered necessary in electroplating, but upon German-silver it solved the problem of the peeling difficulty. The coating of the German-silver by this quick dip with a thin film of mercury, serves to bind the silver to the base metal. It is now a universal method in the flat-ware industry and without it good, silver plated ware cannot be made.

From its inception, we find no radical change in the method employed in silver plating. Apparatus has been modified and better raw materials have been obtained, but in its essential feature we find little change. In some respects, indeed, we find that history is repeating itself for there is now a strong

tendency to use the so-called "bright" silver solution in the plating of flat-ware. This solution, of course, is one containing a small amount of bi-sulphide of carbon and which produces a smooth silver deposit.

Strange to say, this method was patented in 1847 by Morris Lyons and William Milward of England and was used and is still employed to a large extent in England. In the United States, it has been used on flat-ware for the past few years by some concerns and it is expected that it will be used still more extensively. Its full value lies in the fact that three times the regular current density can be employed and this means, of course, that three times as much silver can be deposited in a given time. Three times as much work can then be obtained from a tank in a given time. The deposit is a trifle hard, but stands burnishing well.

We must not overlook the progress that has been made in the silver plating of steel cutlery. It has always been one of the difficult lines of the trade. Many of the early difficulties were caused by the use of poor steel, full of seams, but now good steel, made especially for the purpose can be obtained. I believe platers now fully realize that these seams cannot be covered up in plating, however, small they may be.

The usual methods followed in the electroplating of metals were found wanting in plating steel. It was found extremely difficult to produce a silver deposit that would not strip when burnished. The "quick" dip did not solve the problem for mercury does not amalgamate with steel. Many modifications of the solution were tried and it was finally found that the cleaning of the steel had more to do with the problem than anything else. Steel rusts so easily when chemically clean that the problem resolved itself into the removal of the grease and oil and the prevention of the rusting of the steel before it entered the silver solutions. As now followed in general practice, two striking solutions are used. One acts in the role of an electric cleaner, while the other is the regular strike. In this manner it is possible to work up to the desired degree before the heavy silver coating is put on.

At one time copper plating the steel was carried out and the silver was then deposited upon the copper. This process neither obviated the trouble of peeling, nor satisfied the customer. The wearing of the silver from the edge of the knife, exposed the copper. At that time there was a wave of suspicion passing through the civilized world in regard to the poisonous qualities of copper and brass. Blood poisoning was always traced to pin pricks and the presence of verdigris on the point. Ptomaine poisoning was traced to lead pipe used for carrying drinking water. And so it was with the copper knife. This metal poisoning fallacy, however, has become a thing of the past, but the coppering of cutlery previous to silvering went with it.

When nickel plating came in, the cutlery manufacturers hailed it with glee. It seemed to solve the problem and all knife manufacturers began to nickel plate their goods before silvering. It was soon found, however, that the peeling was very prevalent and the nickel had an exasperating way of coming off in layers carrying the silver with it. Later, with additional care in cleaning, the nickel remained on better but it did not prove satisfactory at all and it is not used at the present time to any extent except on cheap work where little silver is put on.

Let us look backward in the nickel plating industry and we will, I believe, find considerably more improvement than in the silver plating trade. A man is known by his deeds and so is the condition of an art by the quality of the product produced. I will frankly say that the quality of nickel plating now turned out is particularly creditable, both in the matter of color and in adherence.

That nickel plating has actually arrived at a satisfactory state is evidenced by the statement of Roseleur, that eminent French electroplater, somewhere in the early '70's. He said:

"Nickel deposited in the wet way is whitish with a slightly yellow tinge, resembling the alloy for cymbals. The application is without industrial uses since nickel costs about five times as much as copper and presents the same disadvantages, including poisonous qualities."

That Roseleur was born too early needs no argument.

Although disputed by Gore, who says that he used the double sulphate solution for nickel plating before Dr. Adams, the actual discovery of commercial nickel plating belongs to Dr. Isaac Adams, then of Boston. While nickel had been deposited before this time from other solutions, they were not satisfactory and no use was made of the knowledge. Dr. Adams found that the double sulphate of nickel and ammonia formed an excellent solu-

tion from which nickel could be deposited of good color, adherent and soft.

The first application of nickel plating was made by Dr. Adams himself in making nickel electrotypes, but this was soon abandoned and a new article of manufacture known as the "nickel plated gas tip" was put on the market. Joseph Smith, a gas fixture dealer of Boston was associated with Dr. Adams in the production of these tips, and the non-corrosive quality of the nickel was found of value in the production of a good tip. The lava tip, however, was soon found so much superior that it replaced the nickel plated iron tip and this industry then passed out of existence.

The failure of the gas tip industry was followed by the starting of the firm of Wm. H. Remington & Co., on Province St., Boston. Dr. Adams had made the gas tips in 1865 and had a 20 gallon nickel solution. The Remington firm started in 1868 with 200 gallons and 24 Grove batteries. The full current was used and some 50 volts obtained. The full strength of the battery was used on one tank. The firm made a failure of the business and Dr. Adams, who was not financially interested in it, adjusted it and out of it grew the Boston Nickel Plating Co., which is the oldest nickel plating concern in the world. It may be of interest to know that the deposit obtained in the Remington solution was in the form of small, brown spangles that peeled or flaked off in the solution. The double chloride solution was used.

It was in the year 1869 that Dr. Adams took out his famous patent for nickel plating. Many other nickel patents were also granted him but the solution was the only one that caused any interest.

The solution which he patented was the double sulphate of nickel and ammonia as used to-day, but in connection with it a very singular thing in patent law took place. Dr. Adam's claim was that the double sulphate solution should be free from potash, lime, soda and nitric acid and it would seem from the opinions given on the patent at that time, that it was the essential feature of the patent. The patent, then, was *granted upon something that must be done and not upon something that one must do* and in this respect it stands unique in patent law.

In 1869, Dr. Adams established a nickel plating shop in New York City on Crosby Street and placed Luther L. Smith in charge of it. Mr. Smith was a natural inventor and devised several polishing appliances. He also installed in the shop the first dynamo (a Wilde machine) ever used in the plating industry. Mr. Smith afterwards moved to Ansonia, Conn. and became a neighbor of mine and from whom I fortunately gleaned much interesting information. Later I will speak of some of his ventures.

In connection with E. A. Quintard, Dr. Adams visited England and established the first English plant in Liverpool. Later a large plant was established in Birmingham. Mr. Quintard, whom I afterwards knew slightly, became superintendent of the New Haven and Derby Railroad. Both Mr. Smith and Mr. Quintard are now dead.

In the early days of the nickel plating industry, Dr. Adams established his own shops, but later the demand became such that he licensed other people to use it. If my memory is right I believe that 2 cents per gallon was the royalty charged and periodically Dr. Adams or his representative came around to collect the money. Various attempts were made to evade payment and to fight the patent, but Dr. Adams won in each instance. The users had to pay up. At the expiration of the patent,, however, many concerns which had held off on account of the royalty started nickel plating plants and there was a great increase in the amount of nickel plating done.

I well remember when nickel plating first became a commercial proposition, like many other newly used metals, such as aluminum at the present time, it was over-rated. Because of its rarity people used it as they would gold and silver.

I have brought with me to-night a placque of Royal copper made sometime in the early '80's at the Bradley & Hubbard works in Meriden by a Frenchman whose name I cannot recall. It is, as far as known, the first example of Royal copper ever produced in this country and the design on it has been etched: True to the spirit at that time, the flowers on it were nickel plated and it was looked upon as a remarkable production. How many makers of art metal wares to-day would use nickel plating in this manner?

I also recollect, at about the same time or earlier, I believe it was about the time of the Centennial, in 1876, my family had a relative who was in the jewelry business and from whom we were going to purchase a britannia syrup cup silver plated. My father was a believer in nickel plating and he had the

cup sent back to the Meriden concern which stripped the silver and then gave it a heavy coating of nickel. I believe they understood nickel as well as anyone at that time, but the purchase proved a failure although greatly admired for a short time. Soon the nickel began to peel and finally came off in layers with the ruin of the cup. This cup had much effect in the trade and was, I believe, the first nickel plated soft metal article that had been made.

I wish to say a few words in regard to Luther L. Smith who, as I previously mentioned, was associated with Dr. Adams in the launching of the nickel plating industry. At that time I lived in Ansonia and Mr. Smith became a neighbor of mine. I do not remember just what brought him there but believe it was in connection with the manufacture of the "Little Joker" plating dynamo that was made by Wallace & Sons in that town. This was the first commercial dynamo made for plating and many of them are still in existence. Mr. Smith, as I previously said, was the first to use a dynamo in electroplating. Wallace & Sons were large brass manufacturers and had entered the manufacture of electrical goods quite extensively.

The first business connection of Mr. Smith I am not sure of, but when I first knew him he was engaged in making lamp shells by coating a wax core with graphite, depositing a heavy coating of copper on it and then melting out the wax. In this manner an intricate design was followed at a comparatively low cost for that time. Mr. Smith was quite adept in this art and he plated many pieces of fruit for his acquaintances and the feat was considered one of the triumphs of the age.

The lamps proved a failure for the reason that the copper was never solid and the oil used in them invariably leaked through. It was afterwards believed that this could have been overcome by tinning them, but as far as I know it was never tried. Perhaps the cost of making proved too great.

Soon after this the telephone made its appearance. It was the radical invention of the century and changed business methods and created new industries There was a demand at that time for a wire of higher electrical conductivity than the iron used upon telegraph lines. Hard drawn copper wire had not then been made, and soft copper sagged too much to be of any use.

Mr. Smith conceived the idea that if the iron wire were copper plated, an ideal line for electrical transmission would be produced. The few experiments made proved successful, a patent was applied for and readily granted and what was apparently a new industry was opened up. Messers Mackay and Bennett of the Postal Telegraph Company became interested in the process and upon investigation it looked so good to them that they paid $20,000 for it. Works were immediately erected at Ansonia, Conn., for manufacturing the wire. As near as I recollect some 200 large, circular wood tanks were installed and filled with a sulphate of copper solution. Into these tanks the iron wire was passed after having been given a preliminary cyanide copper coating, and a heavy deposit of copper was put on. When the wire came out of the solution it was completed, and no further work was done on it.

Many hundreds of miles of this wire were thus plated and sent out to be placed on telegraph and telephone lines, and as many hundred miles of wire proved a failure. The process was valueless.

The difference in expansion of the iron and copper and the brittleness of the copper deposit, caused the breakage of the copper when lines were put up. The constant vibration of the line undoubtedly hastened the breakage, but as the strength of a chain is its weakest link, so the conductivity of the wire was only that of the iron at the break.

Now comes the most interesting part of the matter. When the process was found valueless, the land was sold to the Ansonia Brass and Copper Company, the factory torn down and the tanks sold. In the bottom of the tanks was a large accumulation of mud which was about to be thrown away. Every one present knows the unattractive nature of plating tank mud and so was this. What tempted Mr. Smith to have it analyzed I am not quite sure, but have always believed that it was to see if it had any bearing upon the brittle copper deposit. It was looked upon as an impurity and impurities always affect conditions. I know that I personally made the analysis of this mud and when I reported to Mr. Smith, he decieded that he would save it. It will be of interest, of course, to know that out of the tanks he obtained $18,000 worth of silver and gold.

Then came the after effect of this and far reaching it was. The wire proved a failure,

but it indicated to Mr. Smith the possibilities of refining copper in this manner and obtaining the silver and gold as a by-product. Upon the failure of the wire, he started a plant for the electrolytic refining of copper and it was the first or second plant in the world. The wealth in the mud produced in plating the wire had been instrumental in starting the electrolytic copper industry which has now become of such magnitude that nearly all of the copper of the world is refined by it.

I cite these examples to indicate to the members of the National Electroplaters' Association that, while their efforts in contributing original material may not immediately be crowned with success, there is the secondary effect that is sure to come. We cannot have too much knowledge of the plating industry and when contributions are thus made we never know how far reaching the effect may be.

The Electrolytic Etching of Copper and Zinc.

According to a patent recently issued to Albert D. Lapointe of Sioux City, Iowa, the etching of zinc may be readily and expeditiously carried on by electrolytic means. The method is as follows:

The zinc plate, having the necessary resist on it to make the desired design, is placed in a solution of nitrate of zinc standing 35 degrees Beaume'. It is made the anode and a sheet of copper or brass is made the cathode. The etching takes about 15 minutes.

For copper or brass, a solution of nitrate of copper of the same strength is used.

Although pure cobalt has practically the same chemical properties as nickel, it is slightly harder and has a pink shade of color.

In plaster of Paris molding, the usual difficulty is in not completely drying the mold. Unless it is "bone dry" the metal will not fill the mold as the steam produced from the dampness will blow the metal away from the surface of it. In order completely to expel all the moisture from the mold, it must be heated nearly red hot. It should also be used while warm, in order to prevent absorption of moisture from the air.

A Bright Dip for Brass and Bronze Castings.

It is frequently necessary, in a brass foundry, to dip castings and just how to make a dip which will give good results is not known. The dipping of castings requires a different dip from that of sheet metal goods and in order to remove the scale, oxide and sand and leave a bright surface, it must act rather energetically. A dip which will give good results on castings, is usually too violent and

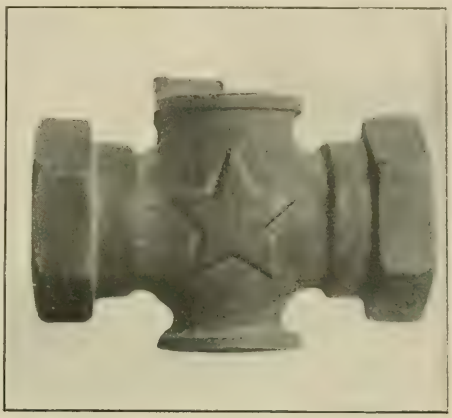


Fig. 1. The Valve Before Dipping.

will give too rough a surface. In the case of castings, however, the surface is rough at the beginning and the acid does not render it more so.

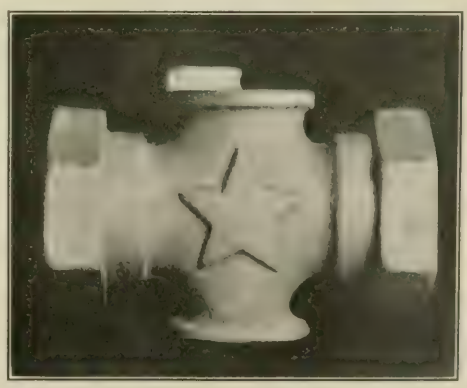


Fig. 2. The Valve After Dipping.

In the case of a dip of strong nitric acid, the casting is given a bright surface but not of the character desired, and the acid also is

apt to work too rapidly. If sulphuric acid is mixed with it in the regular dip proportion, it works too slowly. The addition of a small amount of water has been found to give the necessary action and allow the dip to work rapidly and smoothly.

The following dip will give good results on brass, bronze or composition castings:

Nitric Acid	2 gallons
Sulphuric Acid	1 gallon
Water	½ gallon

The water is first poured in a stone crock and then the nitric acid poured *into* it. The sulphuric acid is then poured into this mixture. It will become hot, and should be allowed to cool down a little before using as it works too rapidly when very hot.

The nitric acid used is the same as aquafortis, of course, and should be from 38 to 41 degrees Beaume' in strength. The sulphuric acid is oil of vitriol and should be about 66 degrees Beaumé.

The dip works best when warm and a temperature of from 100 to 120 degrees F. is satisfactory. If cold it works too slowly.

In dipping the castings, they should be free from grease or oil or the dip will not work evenly. Immerse them in the dip and as soon as the acid begins to "bite," remove and rinse in cold water. If the surface is not even a second dip is usually necessary, but care must be taken about introducing water into the dip. If it contains too much, it will not work well and the surface of the dipped castings will be dull and flat.

In case the dip does not remove all the scale and oxide from the surface, as frequently happens with badly discolored or oxidized castings, it is well to remove the casting from the dip, and without rinsing, allow the acid to act upon the surface in the air. Then return to the dip and afterwards remove and rinse. In this manner, the surface will be bright and uniformly clean.

After the castings have been dipped and the surface is bright and clean, they should be well rinsed in *cold* water to remove every trace of acid, then in hot water that is clean and allowed to dry off spontaneously. It is an excellent plan, after the castings have been well rinsed, to immerse them in a hot water solution containing soap of some kind. Whale oil soap, fig soap or other varieties of a similar nature which are not too strong in alkali may be used. The solution need not be strong. Dissolve an ounce of the soap in a gallon of water and keep hot. Immerse the castings in this solution and then take out and allow them to dry off. In this manner a film of soap is left on the surface which causes the water to dry off or run off from the surface easily and also covers the metal with a greasy coating which will serve to prevent stain and tarnish. This method is used extensively in drying off metal goods after plating or dipping and can be applied to castings with equally as good results.

Reduction of Chloride of Silver by Zinc.

The reduction of chloride of silver by zinc is the simplest method of obtaining metallic silver from it as it is rapid and certain. It is superior to the method employing iron instead of zinc, as this is slow. It is also better than melting the chloride with soda ash.

The chloride of silver which should not be dried after precipitation, (although it will work if it is dry but slower) is placed in a porcelain or glass vessel and a mixture of equal parts of muriatic acid and water is poured on it. Pieces of zinc sheet or other form of the metal are placed in the vessel in contact with the chloride of silver. The acid immediately begins to act upon the zinc and hydrogen gas is liberated. The nascent hydrogen thus formed reduces the chloride of silver to metallic silver and chloride of zinc is produced.

The acid and chloride of silver in the dish should be stirred from time to time to expose fresh surface to the zinc. As the silver is reduced it is noticeable by the dark gray color. When the action ceases, either by the dissolving of all the zinc or by reason of all the acid having been used up, add more zinc or more acid as the case may be and allow the action to go on until all the mass is dark gray and settles readily. When this has taken place it is well to allow the action to continue for a time longer in order to make certain that all the chloride of silver has been reduced.

The solution now contains chloride of zinc, and if the action is allowed to go on until there is no more gas given off when there is still zinc in the vessel, the chloride of zinc will be neutral. It is readily poured off and may be employed as a soldering flux. The metallic silver is washed by pouring water on it and stirring, afterwards pouring off the water

after the silver has settled. The washing is repeated five or six times or more until all the chloride of zinc is washed out. The silver is then dried and melted in a graphite crucible under a layer of borax. If well washed from the zinc, the silver will be pure.

Sulphuric acid may be used instead of the muriatic acid, but does not work as rapidly. If used, it should be diluted with about 20 parts of water.

An Inexpensive Method of Placing Patterns on a Plate.

The process recently patented by Hugh McPhee of Tarrytown, N. Y., foreman of the brass foundry of the Maxwell-Briscoe Motor Co., for putting patterns on plates, has met with such success that we feel justified in calling the attention of brass founders to it.

The advantages of the process are:

1. Reduction of expensive pattern shop labor.

The Method of Placing the Patterns on the Plate.

Fulminate of gold is made by precipitating a solution of chloride of gold with ammonia. It is a very useful material in gold plating as it may be used for replenishing a gold plating bath without introducing any foreign substance. For this reason it has always been extensively used and gives an excellent gold deposit.

2. The mounting of patterns heretofore thought impossible, because of a lug or boss being off-center, and thus preventing a straight parting line.

3. The mounting of gates of patterns, now being used on the bench, without additional pattern shop expense.

4. Perfectly matched castings, as shifts are impossible.

Where no pattern whatever has been made of the piece to be molded or mounted, a master pattern of wood is first made. From this, the patterns necessary to fill a flask are made of metal. They may be made of any desired metal and cast solid or cored out as may be necessary for rendering them light. These patterns are finished up in the pattern shop, but all other work on them is done in the foundry.

The body of the plate upon which the patterns are mounted is made of a composition as this readily handled, wears like a hard metal and its cost is small. This is encased in an iron frame which holds the flask pins. These frames are drilled to fit the flasks perfectly, in the same manner as plates to which patterns are usually mounted must be.

Should patterns mounted on one of these plates become obselete, the composition center is readily removed and the iron frame can then be used for another plate. Gated patterns on hand, may be used the same as other patterns.

The illustration herewith shown will serve to indicate the method of mounting the patterns and the little expense necessary can at once be appreciated.

A Good Flux for Refining Babbit Metal, Solder or other Tin and Lead Alloys.

When the tin or lead alloys, such as babbitt metals, solders, or type metals become oxidized by overheating or exposure to the air too long while melted; or when they contain zinc or other foreign metals, refining must be carried on. This can be carried on in a small way, even in an iron ladle, by the use of the following flux:

Sal-Ammoniac	4 lbs.
Sulphur	2 lbs.
Powdered Charcoal	1 lb.
Rosin	1 lb.

Grind the whole together so as to thoroughly mix and the flux is then ready for use. It is sprinkled on the surface of the molten metal and stirred in. When the smoke has passed off, the residue is skimmed off when it will be found that the refined metal is clear and flows freely. Several applications of the flux may be necessary in soft metals that are quite impure.

The Making and Casting of Aluminum-Bronze.

Aluminum-bronze is an excellent alloy and is superior, when well cast, to manganese-bronze. The cost of manganese-bronze is so much lower that it has replaced aluminum-bronze to a very large extent and very few foundrymen have had much experience with it.

The superiority of alumnium-bronze over manganese-bronze is in the following properties:

1. It is possible to obtain a higher tensile strength.
2. It is more homogeneous and less apt to crystallize in the center of the casting.
3. It is tougher and will bend more for the same tensile strength.
4. It is more non-corrosive.

The difficulties in casting it are two only:

1. The shrinkage.
2. The oxidation when poured.

The shrinkage is a natural result as all strong alloys shrink excessively. This is always an indication of strong metals. It shrinks more than manganese-bronze.

The oxidation or formation of dross is no more than manganese-bronze, however, and those who are accustomed to the methods of casting this alloy should have no difficulty with aluminum-bronze.

The Mixture.

The best "all around" mixture for sand castings consists of the following:

Copper	90%
Aluminum	10%

If more toughness is desired, then the amount of aluminum may be reduced to 9% and the copper increased to 91%. In case a harder alloy is desired, the aluminum is increased to 11% and the copper reduced to 89%. The 90 and 10 mixture, however, answers for the majority of the work and is known as "10 per-cent alumnium-bronze." For all kinds of engineering castings, marine work, valves, bolts, and similar work it is the mixture to use. The 11% bronze is very hard and without elongation and reduction of area and is suitable for dies and castings that are required to be very hard. The 9% mixture is rarely used for castings. With the exception of these three mixtures, the other aluminum-bronzes are not used for sand castings.

Making the Aluminum-Bronze.

To make a 10% aluminum-bronze, take the following:

Copper .....90 lbs.
Aluminum .....10 lbs.

As there is very little waste of the aluminum in making, it is ordinarily unnecessary to use any more than the desired amount, although for very accurate work it is necessary to allow about 0.20% for the loss. The following will indicate the actual waste of the aluminum in melting. An aluminum-bronze was made containing 90% copper and 10% aluminum. It was analyzed after it had been made and poured into ingots. After melting again, another analysis was made. The results were as follows:

Original Ingot.

Copper 89.98%
Aluminum 10.02%

After Melting.

Copper 90.17%
Aluminum 9.83%

The loss of aluminum in melting was, therefore, 0.19%. This represents the average loss occurring in practice.

The copper used must be of the best quality, if the highest tensile strength is desired. Either the best Lake or electrolytic should be employed. Casting brands or scrap copper do not give good results. The aluminum should be as pure as possible. Ordinary commercial aluminum of about 99% aluminum content is generally employed.

The copper is melted in a graphite crucible without any flux, except to keep it well covered with charcoal. This is quite essential as it prevents the oxidation while the melting is taking place. Put some charcoal in the crucible with the copper while it is melting, and then keep it well covered while the melting is going on.

When the copper is *all* melted, which can be ascertained by an iron or graphite stirrer, the aluminum is introduced. This is previously warmed to dry it, and then added as spelter would be introduced. The aluminum melts and floats to the top. When all has been added and has melted and remains on the top of the copper, stir with a graphite stirrer in a very thorough manner. The aluminum and copper immediately react and the resulting bronze immediately becomes white hot. This is caused by the affinity of the copper for the aluminum. Scrap metal should be added to reduce the heat of the bronze, and then it is poured into ingot molds.

Do not attempt to use the aluminum bronze for making castings upon the first melt. It is never good. The ingots, thus made should be remelted and poured into the castings. In this manner it is possible to obtain satisfactory metal.

Melting the Metal for Making Castings.

The ingot metal obtained by melting the aluminum bronze once is used for making the castings. It is remelted in crucibles and kept well covered with charcoal. Like manganese-

Gate of Aluminum-Bronze Showing Deep Shrinkage.

bronze, the secret of obtaining a high tensile strength and sound castings is in the melting. If overheated, or allowed to "soak" in the fire (i. e. to remain in the furnace for some time after it has melted) gas will be absorbed from the products of combustion, and when the casting cools in the mold, these gases are expelled with the formation of blowholes. The right method of melting is to melt metal, keep well covered with charcoal, and when at the right pouring temperature, remove and pour into the mold. *In order to obtain the best results, the mold should always be ready before the metal.* It is a common error to have the metal melted before the mold is completed and then allow it to "soak." This in-

variably results in injury to the aluminum-bronze; in fact, this rule is equally applicable to all metals.

The mold used for casting aluminum-bronze is made of green sand as this has been found preferable to a dry sand mold. Dry sand molds are hard and do not allow the casting to contract readily without rupture, while a green sand mold is soft and does not interfere with the shrinkage. The mold should be rammed as soft as possible and the sand worked as dry as it can be used. These two features are very essential as may be indicated as follows:

A mold rammed too hard will not allow the metal to shrink evenly and the casting will usually crack. In addition, such a mold is apt to "blow" and produce a bad spot on the surface of the casting.

A mold that is made of sand too wet will cause the metal to bubble when poured with the formation of dross.

Risers.

Like manganese-bronze, risers must be used on an aluminum-bronze casting without economizing. They must also be of sufficient size to cool after the casting itself has cooled. It is often found that an *apparently* sound casting can be obtained without any risers at all, and the casting has a good appearance. When cut open, however, the inside of the casting will be found hollow. The outside had cooled first, and had drawn from the inside leaving it with a large shrink-hole. Risers are the only "salvation" of aluminum-bronze. When properly placed and of sufficient size, it is possible to make any kind of casting that can be produced in sand.

Dross.

The problem of dross in casting aluminum-bronze is equally as important as the risers, and it is one of the great obstacles in casting this alloy. To prevent its introduction into the mold, the bronze should be poured at the lowest possible temperature at which it will run. It is surprising at how low a heat the metal can be poured, and the large amount of aluminum in it is the reason for it. Although apparently sluggish, it will run into the thin portions without difficulty.

In order to keep the dross out of the castings, as long a gate as possible should be used. The bronze thus clears itself while running into the mold and the dross will be found in the gate and not in the casting. Pour quietly and do not attempt to force the metal into the mould or the dross will be forced in also. In large castings, the use of a skim-gate is very efficacious and holds back the dross to a remarkable degree. The use of a horn-sprue is also necessary in large castings. It may be said, however, that care must be taken to avoid allowing the bronze to drop too far in the mold and thus stir it up while running. It is a rule in casting aluminum-bronze to have it run as quietly as possible. Whenever it is agitated, dross forms.

Difficulties and Cause.

The difficulties may be summed up as follows:

Casting cracked. Sand rammed too hard or poor copper containing impurities has been used.

Shrink-holes in casting. Risers not large enough or not placed in right position.

Blowholes in casting. Metal not melted twice or overheated in melting.

Wavy and Dirty Spot on Casting. Blow from wet sand or sand rammed too hard without venting.

Dross in casting. Gate too short, metal poured too rapidly, metal poured too hot. Wet sand, which agitates the metal by expulsion of steam, also causes it.

As a usual rule, all aluminum-bronze castings should be poured "flat" as there is no difficulty in running them and they will come cleaner than when poured on end. The appearance of the top of the gate is usually a good indication of the character of an aluminum-bronze casting, and when it shrinks down deeply, like that shown in the illustration, the casting will usually be found sound.

It is standard practice to keep brass or bronze covered with charcoal while melted. Charcoal forms a reducing covering for the metal and is free from sulphur.

Valve castings, bronze pump cylinders and similar castings to stand pressure, may be prevented from leaking by pouring shellac on the inside and then applying air pressure to force it into the press. When this has been done, the casting is warmed for some time to harden the shellac. This process is more efficacious in stopping the "sweating" of castings than it is in eliminating pin holes leakages.

Making Tungsten Lamp Filaments in England.

The following description of the method of making tungsten lamp filaments in England is from the *Ironmongers' Chronicle*:

The tungsten, as received from the Continent, is a black powder of flour-like fineness, but it is not fine enough for making filaments, and has to be re-ground for ten days in a mill at the works. It is then taken to the chemical department, and spends first thirty hours in hydrochloric acid, and then twenty-four hours in an alkali solution to burn the metal. It is then copiously washed with distilled water, and the resulting paste is afterwards "peptised" with a solution of ammonium chloride. Altogether the several operations on the tungsten paste take ten days in the chemical department. Then it goes to the private laboratory, where it is elaborately tested for purity, and then calendered; that is, rolled between polished steel rolls, to make it dry and crisp before it is drawn into filaments. The tungsten paste is then taken to the "squirting" room. Here it is placed in a machine of special design, and forced or squirted through diamond dies of a diameter of .004 of an inch, and the filament is drawn out like a fine glossy hair, .020 of a millimetre in diameter. The filaments fall from the diamond dies on a sheet of white paper on a shifting table, so that they form graceful loops. Then they are cut into lengths, and are baked for a short time in a gas oven. Thence they are taken to the forming department. Here each filament is placed in a vacuum jar, and an electric current is passed through it to "form" it. At first the filament glows a dull red, and then quickly brightens to brilliant incandescence, when the current is automatically cut off, and the filament is ready for taking to the lamp department. In the forming room each girl has to look after two vacuum chambers, and the deftness and skill with which they handle the hair-fine filaments is remarkable.

In using chloride of zinc as a soldering flux, it should be as strong as possible. When it contains water, it does not work as readily, as the water must be evaporated before the flux acts on the solder and thus hinders the rapidity of action.

The "Eclipse" Air-Brush for Lacquering.

A new air-brush for use in lacquering metal goods has been developed by the Eclipse Air-Brush and Compressor Co. of Bloomfield, N. J., and which is herewith illustrated. It is constructed upon scientific principles and is an efficient machine.

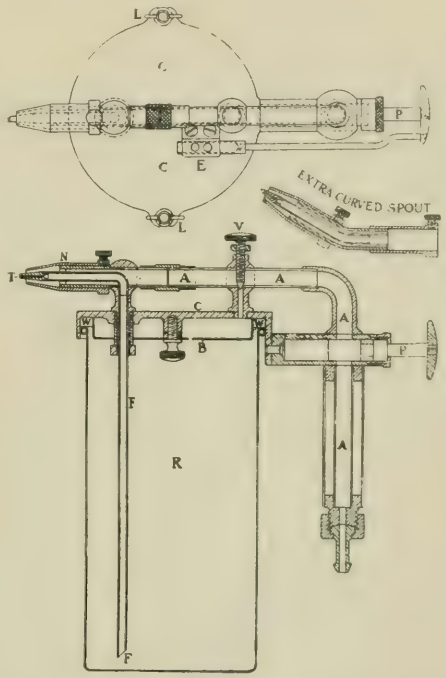


Fig. 1. Arrangement of the "Eclipse" Air Brush.

The brush is operated at a pressure of from 5 to 25 lbs. It is air-tight and cannot spill or drip. It can be tipped or turned in any way without leakage. No alignment of the nozzles is necessary and it cannot get out of adjustment. The parts are readily cleaned and are carefully made for hard usage in the factory.

The advantage of the spraying method for lacquering needs no comment except to say that it is rapidly increasing. It has much superiority over brush lacquering as an even coating may be obtained without danger of showing brush marks. The lacquer may also be put on as thickly as desired which cannot be done with the brush as one coat will take off the previous one.

This company is also placing on the market the "Eclipse Air Filter," shown in Fig. 2. These filters may be used on any air brush as well as those made by this company, and the

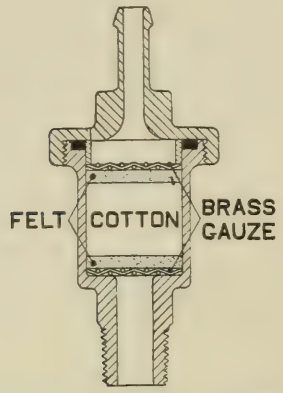
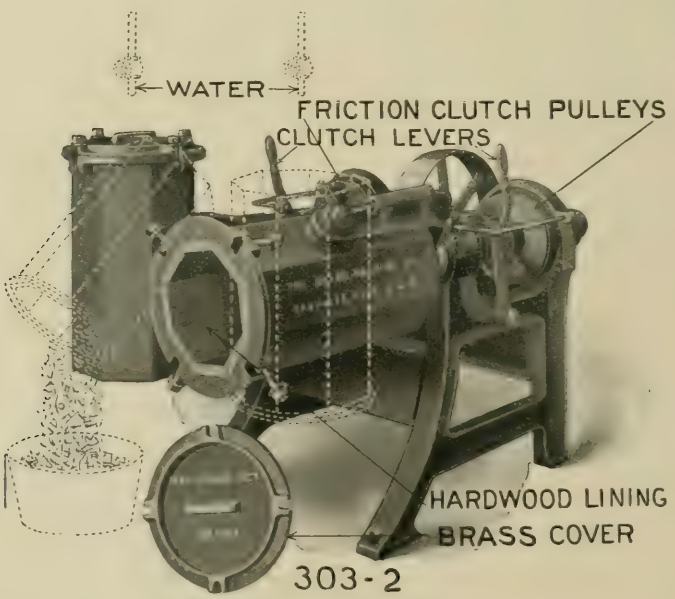


Fig. 2. The "Eclipse" Air Filter.

air used for spraying the lacquer is thus freed from oil, dirt, moisture or dust which will spoil the work.



The "Baird" Improved Ball Burnishing Barrel.

The remarkable success of the Double Horizontal Tilting Tumbling Barrel built by the Baird Machine Co., Oakville, Conn., for use with steel balls in the burnishing and buffing process, has resulted in the developme... perfection of many original ideas, all o... which are incorporated in the new design of machine for this work as illustrated herewith.

When in operation, the barrels are in a horizontal position, but for emptying or filling they may be easily tilted as they are supported on trunnions near their centers by heavy yokes secured to the driving shafts. The locking device which holds them in a horizontal position is simple and convenient, the method of holding the cover to which a gasket is secured, effectually prevents leakage, requires very little time to operate and affords no loose parts to get lost. A pulley of ample size drives both barrels through suitable bevel gears and friction clutches and the arrangement is such that either barrel may be operated entirely independent of the other. This allows the operator to run one barrel while emptying or filling the other which results in considerable saving of time. Owing to the use of friction clutches the driving pulley should be bolted direct to line shaft, the use of a countershaft being unnecessary. All bearings are bronze bushed and of generous proportions, the main shaft bearings being ring oiled. The barrels are polygonal and are lined with maple, this construction permitting of the easy removal of all wearing parts, pro-

longing the life of the machine almost indefinitely, and also of rolling brass or plated arti-

The barrels inside are 10½ inches in diameter and 24 inches long, experience having taught us that the small diameter lessens the danger of bending, denting or otherwise injuring small or delicate parts without retarding the speed or quality of finish.

The Automatic Buffing of Metal Goods.

The difficulty experienced in buffing large articles by hand has been overcome by the automatic buffing machine made by The Automatic Buffing Machine Co. of Buffalo, N. Y. This machine is herewith shown and is intended for the polishing and buffing of large or small metal goods, such as lamp parts, shells, rings and many similar classes of work.

The article to be buffed is chucked on the end of the machine and is automatically fed against the polishing or buffing wheel. The power for driving the machine is obtained by a shaft driven from overhead. A special polishing lathe carries the buff or polishing wheels and this is driven by a belt.

Owing to the uniform pressure obtained on the buff wheels, it is unnecessary to use the highest grade of buff wheels, but cheap ones answer all purposes. Skilled labor is unnecessary in operating it and a boy can attend to two machines.

The Automatic Buffing Machines in Operation.

Electric cleaners are not extensively used on brass as they do not give as good results as on steel. While they work well on brass when new, a small amount of the metal dissolves during each immersion and then deposits upon the surface of the next article immersed making a film on the surface which causes the metal deposited upon it to peel. For iron and steel, electric cleaners are excellent and extensively used.

Questions and Answers.

QUESTION No. 941. We submit some steel buckles to you. These are to be plated with copper and then oxidized in liver of sulphur. In other words, the goods are to be finished in "oxidized copper." The buckles are plated in baskets in a cyanide copper solution standing 15° Beaumé and for about 20 minutes. They are then oxidized in a weak liver of sulphur solution, not over ½ oz. to the gallon. The copper deposit itself stands well on the wheel, but when we buff after oxidizing, the wheel cuts through to the steel. We use a small felt wheel about 4½ in. in diamter by ¼ in. face. We have tried various speeds but without result. We want to cut through the oxidize in places so that the copper will show, but when we attempt it, we always cut through to the steel. What kind of a wheel should be used?

Answer. Your difficulty is in not depositing enough copper on the buckles. You must realize that the liver of sulphur attacks the copper, forming sulphide of copper. When the copper deposit is quite thin, as yours is, it is completely converted into sulphide of copper. When the felt wheel strikes it, therefore, it is removed and the steel left bare.

The remedy is to put on a heavier copper deposit. It would seem that either your current is deficient or your solution does not contain enough copper so that you are not putting on enough copper in the given time. From 20 to 30 minutes ought to give you a deposit that will stand if your solution is strong enough in metal and you use a current of the right strength. You can, of course, give your buckles a longer time in the solution.

QUESTION No. 942. In casting manganese bronze handles on malleable iron automobile levers, how can the porosity be avoided? The castings are spongy and unsound.

Answer. You should have no difficulty with this operation. In fact, the bronze should cast very soundly as the malleable iron handle acts as a chill. The handle should first be heated red hot, however, to burn off grease and oil and then allowed to cool before setting in the mold. You may be pouring the bronze too hot as this will cause the casting to come full of dross and spongy. Pour as dull as possible and arrange to flow the metal through the mold in order to heat up the iron. If this is not done, it may be difficult to cast the manganese bronze around the iron, particularly if a light shell only is to be put on.

QUESTION No. 944. Can you advise a cheap brass mixture for making hinges? These are to be polished and nickel plated. The metal must stand some bending without breaking and when cast, run up full in the casting. We are using a mixture of 2 parts of copper and 1 part of spelter, but find it too expensive for the class of work upon which the goods are to be used.

Answer. As the color of the brass is of no importance if the hinges are to be nickel plated, we suggest the use of the following mixture:

Copper	57 lbs.
Zinc	43 lbs.
Aluminum	4 oz.

The mixture must be cast at as low a heat as it can be poured, and it will be found to run very freely. The mixture will stand some bending, but if found too stiff, less spelter (zinc) can be employed. You cannot cast the mixture without the aluminum.

QUESTION No. 946. We are running a small blast furnace for smelting fine brass washings and grindings. The furnace is water jacketed. We are using limestone and plaster of Paris for a flux. We are not obtaining anything like the quantity of metal that we should, according to the analysis. The slags seem to be heavy and carry from 25 to 50 per cent in copper. What is the difficulty?

Answer. The trouble is with your flux. You should not use the plaster of Paris in a blast furnace, as the sulphate of lime (of which it is composed), is reduced by the coke to sulphide which combines with the copper forming a matte. This matte is your slag and carries a large amount of copper as sulphide. The fluxes customarily used in smelting copper bearing material are limestone and iron cinder. The iron cinder is really a silicate of iron and is obtained from mills which roll iron. It is the slag which runs out from the heating furnaces and is produced by the action of the hot oxide of iron on the fire brick in the furnace bottom. By the use of such cinder, iron is introduced into the slag, and when it is the copper does not enter except in a small amount. In other words, by having the slag contain iron, the copper is practically kept out. It is possible, under such conditions, to produce a slag with about 1% of copper in it, which is quite low. You can use the limestone alone, but the results are not as good .and more copper enters the slag Your present difficulty, however, is in the use of the plaster of Paris.

QUESTION No. 948. What metals are now used for the spark point of the spark-plugs of gasoline automobile engines?

Answer. Pure nickel wire is now very extensively used for this purpose as it has a high melting point and does not corrode or tarnish. While platinum or an alloy of platinum and iridium is the best for this purpose, the cost is such as to prohibit their use in many instances. The nickel wire seems to work well.

QUESTION No. 949. Is metallic cobalt present in all commercial nickel? If so, why is it that analyses do not show it? What is the effect of cobalt on nickel, particularly in electroplating?

Answer. Metallic cobalt is present in small amounts in all commercial nickel. In commercial chemical analysis it is not customary

to separate it from the nickel as it is quite a difficult and unsatisfactory operation and is not considered necessary. The nickel and cobalt are obtained together. Cobalt hardens nickel when present in considerable quantity, but in the amount found in commercial nickel the effect is very slight. Otherwise there is no effect. Cobalt is so nearly akin to nickel and is equally as non-corrosive, that commercially one is as good as the other. Cobalt could be used in place of nickel if desired. Ordinary nickel contains about 1% of cobalt.

QUESTION No. 950. What is the effect of iron in a nickel solution? There seems to be a difference of opinion on the subject. Some platers say that the purest nickel is the best for depositing, while others maintain that the addition of iron gives a whiter nickel.

Answer. The effect of iron on nickel is to render it harder and also a trifle whiter. Whether it is good policy to use a pure nickel anode or one that is alloyed with iron will remain with the plater and he will have to decide according to his own case. In stove work, a nickel anode containing a large amount of iron is generally employed. For ordinary work an anode containing from 90 to 92 per-cent of nickel is generally used. If the softest nickel is desired, however, the pure nickel must be employed, but it is rarely necessary. The presence of a small quantity of iron in the nickel deposit seems to be no disadvantage, and anodes containing iron work much better in the solution than those that are pure. When the nickel deposit is not forced, and a weak current only is employed, very little iron is deposited with the nickel.

QUESTION No. 951. What can be used for cleaning brass castings in a wet tumbling barrel?

Answer. An excellent material for this purpose is small pieces of hard slag. They have sharp edges and remove the sand from the castings readily. Iron stars are also excellent. Ordinary trap rock may also be used. In fact, any kind of stone that is hard and breaks with sharp edges. Ordinary pebbles have a round surface and do not attack the surface of the casting. Some brass founders use their furnace ashes in the barrel and wash them while the castings are being tumbled. Fire brick may also be used for tumbling.

QUESTION No. 952. How can a white background be obtained on etched brass dials? The letters on the dials are raised and are to be left black. The order calls for this kind of a finish and I have not been able to obtain it.

Answer. The problem is not as easy as it appears. You will have to do it in the following manner: Before your brass is coated with the resist for etching, deposit a coating of black nickel on it as light as possible and yet have the black color. Then coat with the resist and print as usual for this class of etched work. Then etch as usual with your perchloride of iron. After the required depth has been obtained, rinse the dial and immerse in a weak muriatic acid dip to clean up the etched surface. Then, without removing the resist from the letters, give a deposit in a silver plating solution containing as little free cyanide as possible. The background will be coated with silver, and unless there is a large excess of free cyanide in the solution, the resist will not be attacked. Then remove the resist and you will have a white background with black letters.

QUESTION No. 956. We are nickel plating a number of brass parts on which considerable soft solder is used. The work comes from the tank rather dark. Can you suggest a method or dip to overcome the trouble? We think the solder is the trouble on account of the antimony it contains. The analysis of the solder is as follows:

Tin	45.90%
Lead	52.18%
Antimony	1.75%
Undetermined	0.17%

The dark nickel deposit is mostly in the region of the soldered places so we believe the composition of the solder is responsible for it.

Answer. The composition of the solder has nothing to do with your difficulty. It is caused by the solder becoming stained or corroded previous to immersion in the nickel plating solution, either while being cleaned in the alkali solution or in the acid dip. Solder is easily corroded and when it is, nickel will not deposit upon it and leaves the surface black. If you are careful in cleaning not to corrode the solder you will have no difficulty; or if you find it does corrode or stain and it cannot be avoided, then you will have to scour it clean with pumice and water previous to immersion in the nickel bath. It is possible, however, on the majority of work to clean the soldered pieces without attacking the solder.

QUESTION No. 957. I am having trouble with my sterling silver skillets cracking in rolling. When first passed through the rolls, they begin to crack on the edges. What is the cause of this cracking?

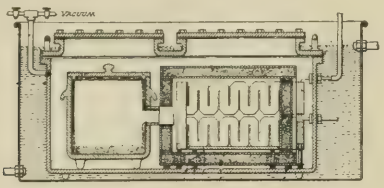
Answer. As we do not know how you are making your skillets we fear we have not sufficient information. The cracking may be caused by the presence of foreign metals, such as antimony, lead or tin, or by the presence of oxide of copper in the silver. The presence of oxide is the usual cause of the cracking when new and pure metals are used. To avoid it, keep the silver well covered with charcoal during the melting so as to prevent the oxidation of the copper. When the copper and the silver have melted, stir and then add metallic cadmium according to the following proportion:

Silver	925 parts
Copper	70 parts
Cadmium	5 parts

The cadmium will reduce the oxide of copper and give a sound and soft metal that will usually roll well. In melting the sterling, do not overheat it as this more than any other cause, is responsible for the oxidation of the copper and the absorption of gases which form pin-holes and blisters.

Patent Abstracts.

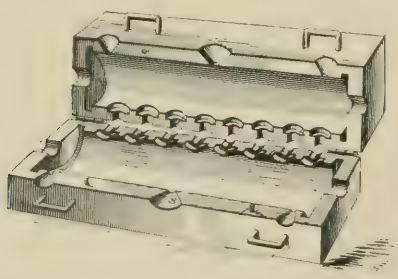
984,503, Feb. 14, 1911. PRODUCING CALCIUM. William C. Arsem of Schenectady, N. Y. Assignor to the General Electric Co. Calcium carbide is reduced in a vacuum furnace by means of heat to metal and carbon.



The furnace is heated by the electric current (by a resistance element) and the calcium can be distilled.

984,137, Feb. 14, 1911. PROCESS OF HARDENING COPPER. Robert A. Hamilton and Joshua Henry of Connellsville, Pa. A mixture of aluminum and iron pyrites is heated in a crucible to a "high temperature" and then poured out and broken up. From 1 to 3 oz. of this treated aluminum is added to each pound of copper while melted. Half an ounce of borax and charcoal are used as a flux. The copper is then cast. It is not stated how hard the copper becomes by the treatment.

984,425, Feb. 14, 1911. MANIFOLD MOLD. Cornelius Gorman of Philadelphia, Pa. A manifold mold so designed that anchors are unnecessary and provisions are

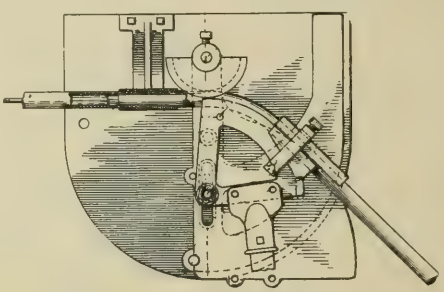


made for the escape of gases. The cope and drag are so connected that the minimum amount of time is consumed in opening the mold.

983,981, Feb. 14, 1911. APPARATUS FOR ANNEALING. Fred H. Daniels of Worcester, Mass. A furnace for use in annealing wire and rods and in pots. The feature in the furnace lies in the means for heating the pots and cooling them, and also for heating the gases burned in the furnace.

982,230, Jan. 24, 1911. COATED OBJECT AND METHOD OF MAKING THE SAME. Leo H. Baekeland of Yonkers, N. Y. A method of reducing the shrinkage of "bakelite" in drying. It is mixed, while in solution, with sand, oxide of iron or other pulverized material, and then applied to an object. The object of the filling material is to eliminate tht shrinkage of the "bakelite" as much as possible in drying.

983664, Feb. 7, 1911. TUBE BENDING MACHINE. John C. Wilson of Kenosha, Wis. Assignor to the Simmons Mfg. Co. of the same place (manufacturers of brass and iron beds). A device for bending tubing for



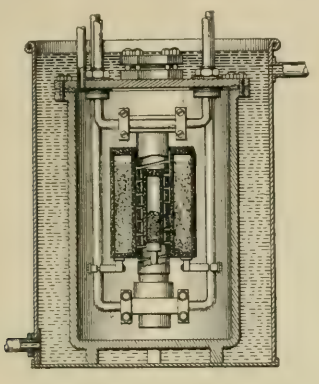
use on bedsteads. The feature of the device lies in the method of producing a hump or curve in the tube. It is now a demand in the trade, for high class beds, that the tubes shall have this hump or curve in order to enhance their appearance.

984,123, Feb. 14, 1911. CARTRIDGE FOR MELTING FURNACES. A cartridge or envelope for the charge used in an electric melting furnace. A sheet steel or other sheet

metal is cupped and the charge to be melted is placed in it. The object is to avoid injury to the walls of the furnace by charging the loose scrap.

982,706, Jan. 31, 1911. MANUFACTURE OF BRIQUETS FOR METALLURGICAL PURPOSES. Wm. Frederick Collins of London, England. Finely divided material for smelting is mixed with water glass as a binder and made into briquets.

984,119, Feb. 14, 1911. ELECTRIC FURNACE. Howard I. Wood, of Schenectady, N. Y. Assignor to the General Electric Co. An electric furnace for the reduction of tantalum oxide to the metallic condition. The



feature of the furnace lies in the protection of the metal from contamination with carbon. The reduction is carried on in a vacuum and the furnace is constructed for this purpose.

983,931, Feb. 14, 1911. DETINNING AND DEGALVANIZING SCRAP. Alexander S. Ramage of Newark, N. J. The process is applied to the simultaneous reclaiming of tin-plate, lead-dross, and galvanized iron scrap. The lead dross or oxide is first dissolved in hot caustic soda and then the lead is precipitated by tin-plate scrap. The tin goes into solution as sodium stannate. The tin is next precipitated galvanized iron scrap. The zinc goes into solution and the tin is obtained in the spongy form. The zinc is then obtained by electrolysis by depositing it on a sheet of zinc and using a sheet iron anode. The caustic soda can then be used again. In this manner the reclaiming of three scrap metals is carried on in one operation.

983,676, Feb. 7, 1911. MOLDER'S FLASK. Royer S. Buch of Elizabethtown, N. J. The flask is intended for use in making small castings. The flask is also of the snap variety and the novelty lies in the manner of making it so that it may be easily removed from the mold.

983,580, Feb. 7, 1911. APPARATUS FOR MAKING CASTINGS. William H. Taggart of Chicago, Ill. A method of making small castings, particularly those used by dentists, under pressure. The pattern is made of wax and imbedded in plaster of Paris. The metal is then forced in by a special pressure device.

983,727, Feb. 7, 1911. ELECTROCHEMICAL PROCESS FOR CLEANING AND POLISHING SILVER PLATE. Anthony Maurice Kohler of Brixton, London, England. The silver is immersed in an alkali solution, such as that of caustic soda, and brought in contact with metallic aluminum. In this manner the tarnish or stain is removed by the nascent hydrogen set free. The use of aluminum alloys as well as aluminum is claimed.

982,971, Jan. 31, 1911. MOLD MAKING MACHINE. Geo. A. McKeel of Cleveland, Ohio. Assignor to the Osborn Mfg. Co. of the same city. A molding machine in which the flask is stripped from the pattern by a direct downward movement. The improvement lies in the mechanism used for making the draw so that it is easy and continuous for the full length of the pattern.

983,430, Feb. 7, 1911. PROCESS OF MANUFACTURING IRON ELECTRODES FOR USE IN ALKALINE ACCUMULATORS. Axel T. K. Estelle of Fliseryd, Sweden. An alloy of iron and cadmium is made by the electro-deposition of the two metals together and then pressing the finely divided material into cakes. It is claimed that a capacity of 1 ampere hour for each 3.54 grams of the alloy (corresponding to 82.3% of the greatest obtainable capacity) can be obtained. Alkaline solutions are used.

983,377, Feb. 7, 1911. METHOD OF PROTECTING IRON FROM RUST. Albert Lang of Karlsruhe, Germany. The iron is treated with aluminum sulphide or magnesium sulphide in the form of powder and mixed with oil. The iron is thus converted into sulphide. The surface is then colored with an analine dye.

982,370, Jan. 24, 1911. COMPOSITION FOR MAKING GOLD LEAF. Leonard Kurz of Fuerth, Germany. A method of making bronze leaf by using bronze powder and a mixture of amyl acetate, benzine, methyl alcohol, castor oil, and soluble cotton. The mass is floated on water and a leaf obtained that may be used like a beaten metal leaf.

984,461, Feb. 14, 1911. PATTERN PLATE. John Bayer of Cleveland, Ohio. A method of making patterns so that the cope and nowel of the flask may be rammed together without the necessity of splitting the flask and withdrawing the pattern.

Trade Items.

The Carlbert Mfg. Co., of New York City, manufacturers of silver deposit wares, have moved from 2973 Third Ave. to 213 East 144th St., in that city. The rapid increase in their business has made this necessary.

The Curtin-Hebert-Anthony Company of Gloversville, N. Y., manufacturers of glove dies and glovers' machinery, have closed their brass foundry and will hereafter purchase their castings from outside parties.

The Maryland Metallizing Company has been organized in Baltimore, Md., with a capital stock of $100,000 to manufacture metallized products, particularly interior finish. Geo. M. Griffith, Calvert Bldg., is interested in the enterprise.

The Taylor & Boggis Foundry Co., of Cleveland, Ohio, manufacturers of builders' hardware and similar goods, and which recently sold its plant in that city, has purchased a tract of land on East 59th St., in that city and will build a new factory on it. It is expected that the new plant can be occupied by the latter part of this year.

The Westfield Foundry & Valve Company has been incorporated in Westfield, Mass., with a capital stock of $55,000. A brass foundry will be built and which is to be 60 x 70 feet. The manufacture of brass and iron valves is to be caried on. C. O. Churchill is president and treasurer of the company; L. Holst, vice-president; and R. H. White, treasurer.

The Henry Souther Engineering Co., 440 Capitol Ave., Hartford, Conn., engineers, metallurgists and analytical chemists, have purchased a plot of land at the corner of Laurel and Willow Sts., adjoining the Columbia Motor Car Co., and have commenced the erection of a new laboratory building on it. The land is 100 x 150 feet and the building will be 35 x 65 feet. A number of new machines for testing will be installed including a 100,000 lb. Olsen testing machine. The company expect to occupy their new building by April.

The Phoenix Flux Company has been organized at 40 Oliver St., Boston, Mass., for the manufacture of an entirely new and novel flux. It is known as "Phoenix-Flux" and they claim it will remove all foreign matter from emery grindings, tailings from magnet machines, sweeps and other foundry refuse. It is also very satisfactory in running down new and old metal turnings and chips. They state that from 100 lbs. of emery grindings and 3 lbs. of the flux, from 85 to 90 lbs. of clean ingot metal have been obtained. The metal was used with perfect safety on automatic machines without finding any iron. The cost of the flux is low. The company have already begun to manufacture the flux and a number of concerns are using it with excellent results.

The Climax Specialty Co., has been incorporated in Norwich, Conn., to manufacture metal specialties and novelties. Jas. C. McPherson is the president of the company and Tyler Crittenden secretary and treasurer.

The A. S. Cumerford Company of Providence, R. I., manufacturers of gold and silver plated wire and fancy wires, have gone into liquidation and the plant and machinery will be sold. The company have been in business for a long time and are located at 129 Eddy St.

William F. Hayes, who was formerly of the firm of Hayes & McFarland of Mt. Vernon, N. Y., manufacturers of silver deposit wares and silver novelties, has incorporated the William F. Hayes Company in that city with a capital stock of $25,00 and will manufacture the same line of goods. The incorporators are William F. Hayes, Marion N. Hayes and Max Mauss of Mt. Vernon.

The Bridgeport Coach Lace Company, 805 Wood Ave., Bridgeport, Conn., manufacturers of automobile and carriage trimmings, have under consideration the starting of a small brass foundry at their factory for the manufacture of automobile hardware. They now use quite a quantity of brass castings in the manufacture of goods which they sell, and are desirous of having a full line of automobile furnishings which can be supplied the trade. They desire catalogues of brass foundry equipment.

The Tacoma Foundry & Machine Co., recently organized in Tacoma, Washington, announce that while they will make iron, steel and brass castings, the brass foundry will not be erected at present. They will carry on a general jobbing business. The main building will be 75 x 100 feet with office and store room and a site of three acres has been obtained. The brass end of the business will be taken up after the iron and steel foundry is under way. John Taylor is the president; Wilson Webb, vice-president; and Thomas B. Hall, secretary and treasurer.

The Bradley Rust Proofing Company, 35 Ferris St., Brooklyn, N. Y., are sole proprietors of the Bradley rust proofing process which is applied to iron and steel. By this process, these metals are given an absolutely dead black finish which penetrates the metal to a considerable depth and renders it proof against atmospheric corrosion or sea water. The finish is also very ornamental and inexpensive. It is done upon the principle of the Bower-Barff process, but with the radical improvements made by Mr. Bradley the inventor. This company has an extensive factory at 37 Ferris St., Brooklyn, N. Y., in which they rust proof articles for the trade and solicit business in this line. Any concerns who desire a durable black finish should correspond with them.

The business and good will of the firm of Ford & Carpenter of Providence, R. I., manufacturing jewelers, have been purchased by J. Perry Carpenter. The manufacture of jewelry novelties is carried on.

A temporary building has been erected by the Madison Brass Works of Madison, Wis. (Schwenn & Vogts, proprietors) to replace the one recently destroyed by fire. A new brass foundry will be erected later.

The Herring-Curtiss Company of Hammondsport, N. Y., manufacturers of motorcycles, aeroplanes and motors, have gone into bankruptcy and Glenn H. Curtiss has purchased the plant and business from the trustee.

The Osborne & Stephenson Mfg. Co., of Plainville, Conn., are starting a brass foundry in connection with their business. It is under the supervision of Luke H. Carter of that place and who previously had been conducting his own brass foundry. This has now been closed. The Osborne & Stephenson Mfg. Co., make small brass goods, screw machine products etc.

The John W. Rapp Co., of College Point, N. Y., and the J. F. Blanchard Co., of Long Island City, N. Y., both makers of metal doors, windows and trimmings, have consolidated under the name of the United States Metal Products Co. The plant at College Point will confine itself to the manufacture of hollow metal work, while the Long Island plant will attend to covered work. The capital stock of the new company is $8,000,000. John W. Rapp is president of the company.

A new brick chimney, a twin to one already in existence there, has just been completed by the Orford Copper Co. at its plant in Bayonne, N. J. These chimneys are among the tallest in the world and are 365 feet high. The new chimney is built on 400 piles driven 14 feet into the earth and filled in with concrete. It has been designed to stand a wind pressure or gale of 100 miles per hour. It is 10 feet in diameter at the top and is provided with outside ladder and lightning rods. The cost was about $40,000.

The banquet of the National Electroplaters' Association held at the Hotel Marlborough, New York City on Feb. 11th. was the most successful yet held. Nearly 200 members and invited guests were present. Much credit is due the banquet committee for manner in which the affair was conducted. Addresses were made by Prof. J. W. Richards of Lehigh University, Geo. M. Howard, Chemist of the Electric Storage Batery Co., of Philadelphia; and Erwin S. Sperry of *The Brass World*. Chas. H. Proctor delivered the opening address. A feature of the evening was the delivering of the charter to the Philadelphia branch of the organization. Dr. W. A. Jones, general manager of the Celluloid Zapon Co., made the presentation in an exceedingly appropriate manner, after which F. C. Clement, for the Philadelphia section, made the speech of acceptance.

The Comptograph Company of Chicago, Ill., manufacturers of adding machines, are to build a new five story factory at 853-863 North Marshfield Ave. The factory will be 50 x 120 feet.

The Western Clock Company of La Salle, Ill., have brought suit against "The Fair," a Chicago department store, alleging infringement in selling their clocks knows as "Big Ben" at less than the agreed price. They have also brought suit against retail dealers who sold the clocks to the store.

The Best Plating Co., 104 North Delaware St., Indianapolis, Ind., job platers, are sending out to the trade an illustrated folder entitled "Hope You Are From Missouri". The folder shows the large variety of work that is done by the company and contains some pithy sayings. They say "We can finish any old thing except a tarnished reputation".

Caron Bros., of Montreal, Manada, manufacturers of jewelry, are erecting a new and commodious factory building at 232 Bleury St., Montreal and which is now practically completed. They believe that it will be the largest and best equipped factory for jewelry manufacture in the Dominion of Canada. It will be known as the Caron Building.

Nelson S. Flanigan of West Cheshire, Conn., who, as mentioned in *The Brass World*, Feb. 1911, discovered a natural coresand on his land in that place, has now organized a company for the purpose of marketing it and which is known as the Cheshire Sand Co. The address of the company is Waterville, Conn. They report an increasing business and the sand has given excellent satisfaction in the manufacture of brass castings wherever used.

Some changes have taken place in the officers of the Winchester Repeating Arms Company of New Haven, Conn., manufacturers of arms and cartridges. Thomas G. Bennett has been succeeded by George E. Hodson as president. Mr. Hodson is also treasurer. Winchester Bennett is first vice-president; Harry S. Leonard, second vice-president; and A. I. Ward secretary. The retiring president, Mr. Bennett, has become consulting director, a new office created. The board of directors remain the same. The desire of Mr. Bennett to retire from active business has brought about these changes.

The Bridgeport Metal Treating Company of Bridgeport, Conn., which has been conducted as a firm, has now been incorporated under the laws of Connecticut with a capital stock of $10,000. W. B. Lashar is president; W. T. Gibson, vice-president; and H. S. Brown, secretary and treasurer. The factory is at 125 Stratford Ave. The business has rapidly increased since starting. The company makes a specialty of hardening, annealing and heat-treating steels of all kinds and many concerns that have their own hardening or annealing plants are sending their difficult work to them. The hardening of high speed and special steel work is a specialty with them.

The American Rotary Valve Co., recently incorporated in Chicago, Ill., with a capital stock of $500,000 to manufacture rotary valves and vacuum cleaners, will establish a plant in the vicinity of Chicago. The office of the company is at 56 Dearborn St.

The Doehler Die Casting Co., Court and Ninth Sts., Brooklyn, N. Y., manufacturers of die castings, are building a four story addition to their factory. It is of concrete construction and will be completed in the middle of this month. The much needed facilities for producing their goods will then be had.

The Cleveland Alloys Company has been incorporated in Cleveland, Ohio, with a capital stock of $3,000 to manufacture solder, aluminum-solder and similar products. A plant has been established at 6816 Union Ave. The officers of the company are M. I. Dreyfoos, president and secretary; H. R. Dreyfoos, vice-president and treasurer; and R. H. Wall, manager.

The Detroit Foundry & Mfg. Co., has been incorporated in Detroit, Mich., with a capital stock of $50,000 to make brass and aluminum castings for automobiles and also other similar goods. A building has been leased at 13 Macomb St. John T. Rich is president of the company; Dr. D. A. MacLachlan, vice-president; Jonathan Palmer Jr, secretary; and Geo. E. Lawson, treasurer.

John C. Wiarda & Co., Green and Provosts Sts., Brooklyn, N. Y., manufacture nickel anodes of all kinds and sizes, nickel salts, both double and single, and other chemicals in large variety used by the plating trade and metal manufacturers. They are also headquarters for fluor-spar, rouges and polishing compositions, acids, cyanide, borax, cream of tartar, soda-ash and any other chemical which is used in these lines of industry.

The Aluminum Goods Mfg. Co., which is a consolidation of a number of plants manufacturing aluminum goods, have passed into the control of the Vits interests of Manitowoc, Wis., and the headquarters and main office will henceforth be located there. George Vits was elected president and general manager. The plant in that place will be enlarged and some $65,000 spent upon it. The eastern plants will gradually be dismantled and the machinery moved to Manitowoc. Aluminum novelties are manufactured.

H. J. Astle & Co., 118 Orange St., Providence, R. I., are sole manufacturers of the "Boland" systems of various kinds. Their Hot Blast Dryer, recently placed on the market has proved to be a rapid and efficient appliance for drying out metal goods after plating, coloring, dipping or other similar treatment in which they are left wet. No sawdust is used and they are dried in a few seconds. The Boland Sand Blasts are also extensively used for a large variety of work. Among the new appliances recently placed in the market is a fire-proof saw-dust box which is a safe and exceptionally convenient appliance for the factory.

Two additions to the factory of the Wire Novelty Manufacturing Co., of West Haven, Conn., are being made. One is to be used as a finishing room. Wire buckles and other wire goods are manufactured.

The Rockwell Furnace, 26 Cortlandt St., New York City, have recently issued two new Bulletins, T and No. 27. Bulletin T describes the Moyer Tramrail for foundry use, and Bulletin 27 is upon rivet heating furnaces.

The American Brass Company of Waterbury, Conn., the holding company for the large brass rolling mills in the Naugatuck Valley comprising it, has declared their regular quarterly dividend of 1¼% and an extra dividend of ¼%, making the whole dividend 1½%.

The Eclipse Air-Brush & Compressor Co., Nelson St., Bloomfield, N. J., manufacturers of the "Eclipse" Air Brush for applying lacquers state that they can insure better results with less time and cost when the brush is used for spraying lacquers on metal goods. It will save 75 per-cent in the finishing room. The air-brush is very simple and does not get out of adjustment.

The Mebane Mfg. Co., of Cleveland, Ohio, are sending out a circular to the trade announcing that they have purchased the flux department of the Allyne Brass Foundry Co., of Cleveland. They are now selling the "Homogen" direct to the trade as heretofore. C. P. Mebane, formerly manager of the Homogen Department of the Allyne Brass Foundry Co., is manager of the new company.

The Springer Lock Mfg. Co., of Belleville, Ont., has taken over the business and plant of the Brass & Steel Goods, Ltd., which they succeed. The manufacture of builders' hardware, trunk and bag hardware, refrigerator locks etc., is carried on. The Hon. Sir Mackenzie Bowell, K. C. M. G., is the president of the company; W. C. Springer, managing director; and A. I. Bird, secretary and treasurer.

The Chicago Hardware Foundry, 548 Washington St., Chicago, Ill., with foundry in North Chicago, Ill., are now placing on the market a product of their foundry, called "Naval Silver" which is a white metal adapted for soda-fountain trimmings, marine trimmings and band instruments. They also make "National-Bronze Mixture" which they say is a close grained and extremely tough metal. In addition they manufacture brass, bronze and aluminum castings for the trade.

The American Oil & Supply Co., 52-54-56 Lafayette St., Newark, N. J., manufacturers of tools, machinery and suplies for silversmiths, manufacturing jewelers and metal workers of all kinds, are now placing a "Flexible Emery Wheel" on the market which is an entirely new article. This emery wheel may be used like any wheel, but its flexibility is such that angles, curved surfaces and rough portions of an article may readily be ground or polished. The wheel does remarkable work.

The Electrolytic Art Metal Company have moved to 402 Beatty St., Trenton, N. J. Fire recently destroyed their plant in that city.

Lortz & Teuscher of Syracuse, N. Y., manufacturers of metal beds, are to erect a three story factory.

The Toledo Nickel Works of Toledo, Ohio, nickel platers, have moved to 17 St. Clair St., in that city and additional equipment added.

Fishel & Co., has been incorporated at 126 West 22nd St., New York City to manufacture sterling silver and jewelry novelties. The president of the company is Leslie H. Fishel.

Edward H. Balevre, 781 Broad St., Newark, N. J., manufacturer and repairer of jewelry, has added a small plating and coloring plant to his establishment.

The plant of the Standard Jewelry Co., on Massachusetts Ave., and Robbins Road, Arlington, Mass., was destroyed by fire on Feb. 20th., with a loss of $15,000. The manufacture of jewelry is carried on.

A. W. Castellanos, 263 Armstrong Ave., Jersey City, N. J., supplies back number of magazines, trade papers and clippings. When in need of anything in this line, correspondence should be opened with him.

The E. R. Hensel Steel & Copper Co., recently incorporated in St. Louis, Mo., and with office in the Security Building, are to act as Western representatives for sheet metal and sheet metal products of steel and copper. They will not engage in manufacturing.

The Gray-Hawley Mfg. Co., of Detroit, Mich., manufacturers of brass specialties for automobiles and motor boats, are to build a new factory on West Jefferson Ave., in that city. It will be 55 x 200 feet, two stories high and to cost about $25,000.

All concerns who do buffing should investigate the automatic buffing machine made by The Automatic Buffing Machine Co., of 56 Indiana St., Buffalo, N. Y. This machine can be operated by unskilled labor and one boy attend to two machines.

The Bennett-O'Connell Company of Chicago, Ill., the well known manufacturers and dealers in platers' suplies and equipment, have opened an office and warehouse in Cleveland, Ohio in order to increase their trade in that vicinity. The branch will be in charge of William A. Dougherty and will be located at 1111 West Superior Ave. A complete stock of supplies will be carried so that prompt shipment can be made.

The Bristol Company of Waterbury, Conn., manufacturers of the "Bristol" Recording Instruments, Pyrometers, etc. have just issued their new Bulletin No. 127. This is a 40 page catalogue of the Bristol Class III Recording Thermometers, including lists of the compensated gas-filled recording thermometers. These instruments are being used for a great variety of applications for recording temperatures up to 800° F. The catalogue describes a number of the important applications and will be sent to those who desire it.

The Brandt-Dent Company of Watertown, Wis., have under consideration the erection of a new brass foundry.

The Wells & Burgess Brass Co., has been incorporated in Chicago, Ill., with a capital stock of $16,000. The incorporators are Bradford Wells, Walter S. Burgess and Alfred T. Carton, 125 Monroe St., Chicago.

The Bingham Mfg. Co., has been incorporated in Cleveland, Ohio, with a capital stock of $25,000 to manufacture automobile carbureters, spark-plugs, and other steel and brass accessories. A plant has been established at 227 Prospect Ave., N. W., in that city.

Personal.

C. P. Karr, for a number of years metallurgical chemist of the Nathan Mfg. Co., of New York City, manufacture of steam goods, has severed his connection with that company.

Herbert Shearer, formerly manager of the Chicago Brass Co., of Kenosha, Wis., has been made manager of the brass department of the Winchester Repeating Arms Co., of New Haven, Conn.

W. R. Hughes, formerly with the Levett Mfg. Co., of New York City, is now representing F. B. Stevens of Detroit, Mich., manufacturer of foundry and electroplaters supplies. He is looking after their interests in Detroit and vicinity.

Thomas Liggett, Jr., has become the new process superintendent of the United States Sherardizing Company of New Castle, Pa. Mr. Liggett is a graduate of Princeton University and has devoted much time to the study of metallurgy.

E. F. Lake, for a number of years steel editor of the *American Machinist*, has severed his connection with that paper and will hereafter act as special correspondent and consulting metallurgist. Expert advice will be given on melting, alloying, casting, welding and heat treating metals. Mr. Lake is located at Ave. B. and 47th. St., Bayonne, N. Y.

S. P. Williams Jr., for a number of years purchasing agent of the American Pin Co., of Waterville, Conn., has severed his connection with the company and is now identified with the Williams Sealing Corporation, 37 Benedict St., Waterbury, Conn. This company was recently started to manufacture bottle caps of a patented nature. J. G. Couch, who has been Mr. Williams' assistant for some time, is now the purchasing agent of the former company.

Obituary.

Le Roy S. White the well known inventor of Waterbury, Conn., died on Feb. 17, aged 82 years. He was the inventor of the first successful machine for burnishing silver plated ware. Machines of this kind are now used by nearly all flat-ware manufacturers.

Current Metal and Supply Prices.

These Prices are net and are for moderate quantities. Smaller quantities command higher prices. Prices subject to fluctuation.

Acetone, pure, 98-99%	lb.	.22
Acid, Acetic, pure, 30%	lb.	.07
Acid, Arsenious (White Arsenic)	lb.	.20
Acid, Benzoic	lb.	.55
Acid, Boracic (Boric), pure	lb.	.12
Acid, Hydrochloric, see Acid, Muriatic.		
Acid, Hydrofluoric, 30%	lb.	.04
Acid, Hydrofluoric, 50%	lb.	.10
Acid, Muriatic, 20°	lb.	.02
Acid, Muriatic, c. p., 20°	lb.	.07
Acid, Nitric, 38°	lb.	.05⅝
Acid, Nitric, 40°	lb.	.05⅞
Acid, Nitric, 42°	lb.	.06¼
Acid, Nitric, c. p.	lb.	.08
Acid, Sulphuric, 66°	lb.	.01¾
Acid, Sulphuric, c. p.	lb.	.06
Alcohol, Wood	gal.	.50
Alcohol, Denatured	gal.	.55
Alum	lb.	.04
Ammonium Sulphate	lb.	.07
Aluminum, Metallic, in Ingots	lb.	.21½
Aqua-Fortis, see Acid, Nitric.		
Ammonia Water (Aqua-Ammonia), 20°	lb.	.04¾
Ammonia Water (Aqua-Ammonia), 26°	lb.	.06¼
Ammonia Water, c. p.	lb.	.08
Ammonium Carbonate, lump	lb.	.15
Ammonium Chloride (Sal-Ammoniac)	lb.	.12
Ammonium Hydrosulphuret	lb.	.30
Ammonium Sulphate	lb.	.07
Ammonium Suphocyanate	lb.	.50
Amyl Acetate	gal.	1.85
Antimony	lb.	.09½
Arsenic, Metallic	lb.	.15
Arsenic, White (Acid Arsenious)	lb.	.20
Argols, White (Cream of Tartar)	lb.	.31
Asphaltum, Commercial	lb.	.05
Asphaltum, Egyptian (Bitumen)	lb.	.30
Benzine	gal.	.15
Benzol, Pure	gal.	.75
Bismuth, Metallic	lb.	2.00
Bitumen, see Asphaltum.		
Blue-Vitriol, see Copper Sulphate.		
Borax, Crystals or Powdered	lb.	.10
Borax Glass	lb.	.35
Cadmium, Metallic	lb.	.70
Carbon Bisulphide	lb.	.10
Calcium Carbonate (Precipitated Chalk)	lb	.10
Chrome-Green	lb.	.50
Copper, Lake, (carload)	lb.	.12¾
Copper, Lake, (cask)	lb.	.13
Copper, Electrolytic, (carload)	lb.	.12½
Copper, Electrolytic, (cask)	lb.	.12¾
Copper, Casting, (carload)	lb.	.12¼
Copper, Casting, (cask)	lb.	.12½
Copper Acetate (Verdigris)	lb.	.35
Copper Carbonate, dry	lb.	.25
Copper Sulphate (Blue-Stone)	lb.	.09
Copperas, see Iron Sulphate.		
Corrosive Sublimate, see Mercury Bichloride.		
Cream-Tartar, see Potassium Bitartarate.		
Cryolite	lb.	.12
Cyanide, see Potassium Cyanide.		
Dextrin	lb.	.15
Emery Flour	lb.	.04
Emery, F F & F F F	lb.	.03
Flint, powdered	lb.	.01
Fluor-Spar	lb.	.01¼
Fusel-Oil	gal.	1.75
Gold Chloride	dwt.	.60
Gum Copal	lb.	.30
Gum Guiacum	lb.	.26
Gum Mastic	lb.	.70
Gum Sandarac	lb.	.35
Gum Shellac, brown	lb.	.50
Gum Shellac, white	lb.	.60
Iron Perchloride	lb.	.25
Iron Sulphate (Copperas)	lb.	.05
Lead Acetate (Sugar of Lead)	lb.	.15
Lead, Pig	lb.	.04½
Lead, Red	lb.	.12
Lead, Yellow Oxide (Litharge)	lb.	.12
Liver of Sulphur, see Potassium Sulphide.		
Manganese, Ferro, 80%	lb.	.10
Manganese, Metallic, pure	lb.	.75
Magnesium, Metallic	lb.	1.50
Mercury Bichloride (Corrosive Sublimate)	lb.	.93
Mercury, Metallic (Quicksilver)	lb.	.42
Mercury Nitrate	lb.	1.50
Mercury Oxide, yellow	lb.	1.80
Nickel and Ammonium Sulphate (Double Salts)	lb.	.16
Nickel Carbonate, dry	lb.	.60
Nickel Chloride	lb.	.50
Nickel Metallic	lb.	.47
Nickel Sulphate (Single Salts)	lb.	.25
Nitre (Saltpetre), see Potassium Nitrate.		
Oil of Vitriol, see Acid, Sulphuric.		
Paraffine	lb.	.15
Phosphorus, yellow	lb.	.40
Phosphorus, red	lb.	1.10
Pitch	lb.	.05
Plaster of Paris, Dental	bbl.	4.00
Platinum Chloride	oz.	20.00
Platinum Metallic	oz.	38.50
Potash-by-Alcohol, in sticks	lb.	.50
Potash, Caustic (Potassium Hydrate)	lb.	.08
Potassium Bichromate	lb.	.14
Potassium Bitartarate (Cream of Tartar)	lb.	.31
Potassium Carbonate (Pearlash)	lb.	.10
Potassium Chlorate	lb.	.15
Potassium Cyanide	lb.	.25
Potassium Iodide	lb.	2.25
Potassium Nitrate (Nitre or Saltpetre)	lb.	.10
Potassium Permanganate	lb.	.17
Potassium, Red Prussiate	lb.	.60
Potassium, Yellow Prussiate	lb.	.24
Potassium Sulphide (Liver of Sulphur)	lb.	.15
Potassium Sulphuret, see Potassium Sulphide.		
Potassium Sulphocyanate	lb.	.70
Pumice, Ground	lb.	.05
Quartz, Powdered	lb.	.01
Rosin, Yellow	lb.	.04
Sal-Ammoniac, see Ammonium Chloride.		
Sal-Soda, see Sodium Carbonate.		
Silver Chloride, dry	oz.	.75
Silver Cyanide	oz.	1.00
Silver, Fine	oz.	.53
Silver Nitrate, crystals	oz.	.50
Soda-Ash	lb.	.05
Sodium Biborate, see Borax.		
Sodium Bisulphite	lb.	.15
Sodium Carbonate (Sal-Soda), crystals	lb.	.02
Sodium Hydrate (Caustic Soda)	lb.	.05
Sodium Hydrate (Caustic Soda) by Alcohol (in sticks)	lb.	.45
Sodium Hyposulphite ("Hypo")	lb.	.04
Sodium Metallic	lb.	.90
Sodium Nitrate	lb.	.05
Sodium Phosphate	lb.	.09
Sodium Silicate (Water-Glass)	lb.	.04
Soot, Calcined	lb.	.15
Spelter, see Zinc.		
Sugar of Lead, see Lead Acetate.		
Sulphur (Brimstone) in lump	lb.	.05
Tin Chloride	lb.	.43
Tin, Metallic	lb.	.42
Turpentine, Venice	lb.	.35
Verdigris, see Copper Acetate.		
Water, Distilled	gal.	.15
Water-Glass, see Sodium Silicate.		
Wax, Beeswax, yellow	lb.	.45
Wax. Carnauba	lb.	.70
Whiting (Ground Chalk)	lb.	.02
Zinc Carbonate, dry	lb.	.19
Zinc Chloride	lb.	,12
Zinc, Sulphate	lb.	.06
Zinc, (spelter)	lb.	.05½

THE BRASS WORLD AND PLATERS' GUIDE

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Amount of Lead to Use in Yellow Brass Castings.

Lead is used in brass castings to render them free cutting. Without it, the metal would be too tough to cut freely. When the brass is free from lead and does not cut readily, it is called "hard". This term is extensively used and is apt to be misleading to those who are not familiar with its meaning. Strictly speaking, such "hard" brass is really soft in the true sense of the word. The name has come into usage on account of its having been applied to the brass by brass turners. To them, brass without lead is actually hard.

When lead is present in brass in a sufficient amount, it produces a shortness in the chips which causes them to break off from the tool and not cling as "hard" brass will do. The only advantage of the lead in brass, therefore, is to render it free cutting. It is not added for the purpose of cheapening it.

If too much lead is added to yellow brass, it is apt to separate from the main body of metal as the casting cools in the sand mold. Such a phenomenon is known as "segregation". If too little lead is used in the brass, it does not cut sufficiently free.

The effect of lead on brass begins to be noticeable in the cutting qualities when about 1% is present. With less it is not manifest; in fact with 0.50% one would scarcely notice that there was any difference in the cutting qualities unless actually compared side by side with a sample containing no lead.

With 2% of lead, the brass cuts freely, but it is not as soft as desired. Makers of drawn brass rod, however, use about this amount of

lead (2.25%) as it has been found to give the necessary results in this class of work and does not give the difficulty in drawing that is experienced when a larger quantity is used, neither is the brass weakened so as to prevent its use for screws etc.

When 3% of lead is used in yellow brass castings, the full free cutting property is found. To be sure, a greater amount of lead imparts greater freedom in cutting, but there is then a liability of a weakness in the casting on account of segregation of the lead.

In good yellow brass, therefore, composed of about 2 parts of copper and 1 part of zinc, the lead should be about 3%. It should not vary over 0.50% either way. It will be found that the best yellow brass for casting purposes contains about this amount. Experience has demonstrated that it is the most desirable content.

Overcoming Spotting Out by the Use of Sodium Salts, Particularly Sodium Cyanide.

One of the worst difficulties in plating castings is the spotting out. This is caused by the plating solution penetrating the pores or cavities in the casting (few castings are found which do not contain more or less of them) and then, when the castings have been finished and lacquered, it works out. While a thorough rinsing will often overcome it, there are instances in which it will not. One of the common methods of overcoming it is to leave the work for a sufficient period of time to give the solution ample time to spot out as much as it will, and then finish. This cannot be used in all instances on account of the lack of time.

When potassium salts are used in a plating solution they are usually the cyanide, carbonate and frequently the caustic potash. In each case, these compounds are deliquescent, that is they have the property of absorbing water from the air and gradually becoming liquid. Place a piece of caustic potash in the air. In a short time it will become moist and finally liquid. Potassium carbonate and potassium cyanide act in the same manner although not quite as rapidly.

Sodium salts have the property of expelling water or drying up when exposed to the air. Sodium carbonate in crystals parts with its water when exposed to the air and becomes a dry, white powder.

The use of sodium salts, therefore, in electroplating will bring about a different condition in the spotting out. In the case of a potassium salt which has penetrated a cavity during the operation of electroplating, the solution will gradually work out, and when exposed on the surface, will absorb water and gradually spread over the surface corroding whatever portion it may touch. When sodium salts are employed in the plating solution, the solution which works out of a cavity will have a tendency to dry up and not spread like a potassium salt. While the spotting out is not entirely overcome by the use of sodium salts, it is greatly lessened and in many instances has been found to be so slight as to be disregarded.

Electrolytic Nickel.

Electrolytic nickel is now a commercial product and is being constantly produced by one of the large nickel refineries in the United States. It is produced in the form of large cathode sheets which have been produced in the process of refining the nickel by the electrolytic method.

The electrolytic nickel thus produced is the purest form of metal that can be obtained and has the advantage of being free from carbon. Its shape is the only disadvantage as it must be cut up in order to allow packing in a rucible for melting. Mills equipped with large alligator shears, however, find no difficulty in cutting it.

The purity of electrolytic nickel is such that some of the German-silver users are now employing it for the manufacture of the best grades of this material. The results so far obtained warrant the continued use in this line of manufacture.

Crucible furnaces in which coke or coal is burned should be repaired at frequent intervals in order to prevent the burning out of the body of the furnace. The fire-brick, burning out around the body of the furnace, increases its capacity and a larger quantity of coal than should be used is taken. For this reason it is not economical to allow furnaces to go too long without repairing. The fuel consumption will then become too large.

The Methods Employed in Preparing Copper Bearing Material for Shipment to Copper Smelters.

Large numbers of scrap metal dealers are scattered over the United States, whose business it is to collect lots of copper bearing material and prepare it for shipping to the copper smelter, who smelts it in a blast furnace and produces blister copper from it, from which refined copper ingot is made by the process of refining in a reverberatory furnace. stances, too, the copper smelter purchases the copper bearing material through a dealer, who acts as an agent, and looks to him to keep them supplied with the necessary quantity and quality of product.

By the term "copper bearing material," is meant any kind of substance containing copper. It makes no difference what the other

Fig. 1. Pile of Brass Skimmings to be Sampled by Quartering Down.

It is the business of these metal dealers to collect small lots of copper bearing material and mix them into a shipment of a car-load so that the minimum freight rate may be obtained in shipping them to the smelter. Large lots, of course, are handled as well and if they are sufficient in quantity, they are shipped without attempting to mix them with any other material. The majority of manufacturers who produce copper bearing material as a refuse product prefer to do business with such a dealer as they are able to obtain quite satisfactory results. In many instances, too, the copper smelter purchases the copper bearing material through a dealer, who acts as an agent, and looks to him to keep them supplied with the necessary quantity and quality of product.

By the term "copper bearing material," is meant any kind of substance containing copper. It makes no difference what the other substances are in it, the copper determines the value. Zinc, tin, lead and sometimes nickel are usually present to a greater or less extent in such material, but they are never reckoned as valuable for the reason that the copper is the one used as the basis of a transaction and the others as elements which are not reclaimed. If, however, a material of this description should contain tin in a quantity of more value than the copper (which is rarely the case) it is reckoned as a tin bearing material and is sold upon the basis of the tin contents and the copper then becomes of no value.

Such a condition is so rarely the case, however, that there is very little material ever found to contain tin enough to change its designation from "copper bearing material" to "tin bearing material" when once sold as such.

The amount of copper in a copper bearing material determines its value. Copper smelters, as a rule will purchase it when the copper is down as low as 5%, but their custom is to purchase all copper bearing material delivered at their works. Low grade material, therefore, is not of sufficient value to pay the freight on it so that there is really a limit as to the amount of copper that can profitably be shipped. Such a limit depends upon the copper market. When copper is low, the limit is higher than when it is high in price. This is readily appreciated when the actual value of a 5% copper bearing material is figured out. If copper is quoted at 12 cents per lb., the copper in it is worth only about half as much were copper 24 cents. At the present market for copper, the limit of successful handling lies between 5% and 10% but even the 10% material is rather low to be handled with any reasonable profit.

The copper bearing material is sold upon the amount of copper it contains. Some smelters make what is called a "flat price," that is so much per lb. for the material delivered at their works, depending upon the copper it contains. Others make a price according to a "sliding scale". This scale is based upon the amount of copper the material contains, and a smelting charge is deducted. In addition, the price paid for the copper in it, depends upon the amount. A certain deduction is made from the market price of copper and the more the material contains, the less the deduction. This practice is quite fair as the cost of smelting low grade material is very much more than in the case of a high grade material. Whatever method is used for purchasing the copper bearing material, either the "flat price" or the "sliding scale", the customer receives the same. One is only another method of figuring the other. In the case of the "flat price", the copper smelters figure all the charges (knowing, of course, the amount of copper in the material), while in the "sliding scale" method, the smelter informs the customer how the cost is figured. As the customer is only interested in the price obtained, one method is as good as another to him.

The material found on the market and classed as copper bearing material is of large variety. Some of it is rich in copper. Others are quite lean. There is a much larger quantity of lean material produced than the rich kind. Some of the principal kinds are as follows:

Red grindings are produced in grinding the gates and fins from brass castings. They are mixed with dirt and emery. They usually run from 60% to 80% in copper. *Yellow grindings* are produced in the grinding of yellow brass castings. They run from 40% to 60% in copper.

Washings are produced in the washing of brass foundry ashes and are really the small metal shot that has dropped into the fire from the crucible. The coal and cinder are washed away, leaving the metal. Red washings are produced from red metals, and yellow washings from yellow brass. When the two are mixed they are known as "mixed washings". There are two kinds of washings: Coarse washings, which are large pieces of metal and comparatively free from coal, coke or slag, and fine washings, which are about the fineness of coarse sand. These are produced from the coarse washings, after the washing operation has been completed, by riddling them. The fine washings are what pass through the riddle. Fine washings usually run from 20% to 35% in copper, depending upon their freedom from slag, coal or coke, and whether the metal is red or yellow. Coarse washings run from 50% to 80% in copper also depending upon the same conditions.

Skimmings are of two kinds: Coarse and fine and one is riddled and the other is not. Skimmings may run from 20% to 40% and it is a singular fact that fine skimmings from yellow brass will run higher in copper than those from red metal. The fact that the oxide of zinc carries copper with it when it oxidizes and is skimmed off is the cause of this fact.

Sweepings result from sweeping up a foundry floor. They are usually quite lean in copper and it is not infrequent that they will carry so little copper as to be of no value. There is so much molding sand tracked around a foundry floor that it is the principal ingredient of the sweeps. Sweeps are usually considered a rather poor material.

Tailings are of two kinds. One is known as Hill barrel tailings and is the fine material that is washed away during the washing of

brass foundry ashes. These are usually so lean that they are of little value. They rarely run over 5% in copper unless the washing has been done very carelessly. The other kind is known as "magnet machine tailings" and result from running chips of brass or composition containing iron over a magnet machine. The iron which is separated by the magnet machine contains considerable brass or composition attached to it mechanically and the quantity depends upon the character of the magnet machine. If poor, the quantity is large. Magnet machine tailings are, as a usual rule, quite lean.

final treatment, however, previous to sending to the copper smelter is the same in each case.

When the scrap metal dealer receives the copper bearing material that has been purchased by him from the producer, the first thing to do is to mix it thoroughly. In Fig. 1 is shown a pile of fine skimmings which is a fair sample of the kind of material that is sold for its copper contents. The operation of mixing is one that is always done by hand and with ordinary labor. The pile is shoveled over until apparently thoroughly mixed. The operation of obtaining the sample then begins.

The laborers begin, after the pile has been

Fig. 2. Small Pile Obtained by Taking Every Tenth Shovelful in Barreling.

Brass foundry ashes are usually so lean that they will not pay for transportation and must be treated by washing to remove the non-metallic material. Washings then result.

There are many other kinds of copper bearing materials, such as clock chips, pin-dust, battery-copper, filings, bronze-powder waste, copper-scale, copper-grease, and similar products resulting as refuse in the metal trades. Many are found in small quantities while others are produced in large amounts. The

mixed thoroughly, by shoveling the skimmings into barrels for shipment. Every tenth shovelful is placed on the floor. When all the pile has been shoveled into the barrels, there will remain a small pile as shown in Fig. 2. This is the representative pile of the large one.

The small pile is then subjected to the quartering down process which consists in mixing the pile again by means of the shovel and then dividing it into quarters. The beginning of this "quartering down" is shown in Fig. 3.

The pile shown has been divided into two parts as seen, and to quarter, each half is again divided.

When the pile has been quartered down, two of the quarters are shoveled into the barrel, and the other two, remaining on the floor, are mixed once more and again quartered down. The two quarters are again shoveled into barrels and the remaining quarters mixed. This quartering down operation is continued until a comparatively small sample is obtained. It is usually carried out until about a peck of the material is obtained if coarse and a quart if fine. When this has been quartered and the two final quarters remain on the floor, they represent the final sample which is used for making the copper assay and upon which the value of the copper bearing material is determined.

There are now two quarters left. The mixing has been carried out and the quartering down followed as described in order to obtain a representative sample of the lot, and the two remaining quarters are supposed to represent it.

The copper assay for determining the value of the sample is made upon the quarters left. The dealer may keep one and the smelter another and two assays made which, if agreeing closely, give the value of the material.

The whole object, in preparing copper bearing material, is to mix the whole so thoroughly that the sample obtained in the final quartering will truly represent the pile. With comparatively fine material, this is readily accomplished, but with coarse material it is quite difficult so thoroughly to mix that each quarter of the final sample will show assays of copper very near one another. It is the only method known, however, which can be used, and even though the results on coarse material are not very close, it must be used in *lieu* of anything better.

Fig. 3. Quartering Down the Small Pile for Obtaining a Small Sample.

A large amount of copper scale, resulting from the hot rolling of copper or the annealing of it, is used in the manufacture of marine paint. It is also used in certain forms of batteries.

A Simple Solution for the Electrodeposition of Tin.

There are many uses for a tin deposit. It is believed that the demand for such a coating is growing, and it would be used more were a suitable solution known which could be employed in all instances. Roseleur's pyrophosphate tin solution is an excellent one for many purposes, and it is capable of giving the whitest tin deposit of any of the known tinning baths. The whiteness, however, is apparent only before scratch-brushing as all tin deposits have the same color after this operation has been concluded. The objection to the pyrophosphate solution is that it must be worked hot and a heavy deposit of tin cannot be obtained except after a period of many hours. It is really unsuited for heavy coating.

The following solution is capable of giving a good, white tin deposit on *all* metals. It requires no chemicals except those which are in every plating room, and is used *cold*. It is as simple a solution as can be made. It contains the following:

For Brass, Copper, Bronze, Etc.

Water	1 gallon
Potassium Cyanide	5 oz.
Caustic Potash	1 oz.
Tin Chloride	1 oz.

For Steel Wrought-Iron and Cast-Iron.

Water	1 gallon
Potassium Cyanide	5 oz.
Caustic Potash	2 oz.
Tin Chloride	2 oz.

The tin chloride used is the regular "tin-salts" of commerce and is the so-called stannous chloride made by dissolving tin in hydrochloric acid.

The object of the caustic potash is to neutralize what free acid there is in the tin chloride before the potassium cyanide is introduced. In this manner there is no expulsion of hydrocyanic acid gas when the tin chloride is dissolved by the cyanide. If the tin chloride is free from acid (which is seldom the case and when it is, it does not dissolve readily) the potash is not required, but it is good policy to use it and then the cyanide employed is not partially neutralized by the acid and its full value is obtained.

Making Up the Solution.

To make up the solution after the formula given, dissolve the caustic potash in the water. Warm water is preferable as the operation is then made more rapid. Then add the tin chloride and stir. Next add the potassium cyanide and stir. If the solution is warm, the tin chloride is dissolved by the cyanide (the potash does not dissolve it as there is not enough used) and a practically clear solution is obtained. As tin chloride frequently contains a small amount of iron, there remains suspended in the liquid a little iron hydroxide. This, however, does no harm, but may be filtered out if desired.

Working the Solution.

The solution may be worked cold or warm. As it works very well cold, it may be used in such a condition whenever desired. When warm it deposits the tin more rapidly.

Block tin anodes (pure tin) are used, either of rolled sheet or cast. As large an anode surface as possible should be employed. The current tension should be from 2½ to 3 volts when the solution is used cold. Less are used when it is run warm.

In from 3 to 5 minutes a good, white and moderately heavy tin deposit is obtained which is suitable for the majority of purposes. A longer time gives a heavier tin deposit, of course, but it then becomes more or less crystalline and the article must be taken out and scratch-brushed. It can then be returned to the solution and an additional deposit put on. By repeating this operation, very heavy tin deposits may be produced. As tin is soft, the deposit responds to the scratch-brush exceedingly well.

It will be noticed that two formulas are given for the solution, one containing twice the amount of tin that is in the other. It has been found that for brass, copper, bronze, etc., the solution containing the least amount of tin works well. This solution can also be used for iron and steel, but it deposits rather slowly. For this reason, the stronger solution is employed and it will be found suitable for cast-iron goods which, as a usual rule, do not take a deposit as readily as other metals, particularly when "over-pickled."

For neutralizing the free acid in a nickel solution, carbonate of nickel is theoretically correct as it does not introduce any foreign element into the solution.

Tricks in the Scrap Metal Trade

Second Paper.

Spurious Castings.

The *shape* of scrap metal always determines its value. Color has nothing to do with the matter. Old steam metal valves are always worth more than faucets or cocks for the reason that they are made of better metal. Both are red, however, and when melted and poured into ingot metal would have the same appearance. Yellow brass sheet scrap is always worth more than chips on account of its superior quality. The same is true of many other kinds of scrap.

Knowing the preceding facts to be true, scrap metal dealers often take advantage of the willingness of brass founders to purchase composition castings that have been scrapped. In the case of composition, brass founders always assume that if the metal was once cast, is red, and has been in use, it must be good. Hence they do not hesitate to purchase any form of composition casting.

Unscrupulous scrap metal dealers have taken advantage of this fact and frequently do this:

Washings, railroad chips mixed with babbitt-metal, or other form of scrap that is of such a character that a brass founder would never think of using it for making castings, are melted and cast into various common shapes found in the trade. As it would hardly pay to make valves or other complicated castings (although there are instances in which it might be done), simple castings only are made. One of the favorite shapes is large rings of the shape of a bearing. When cast, these are broken up and then are ready for sale.

The brass founder, having such broken castings offered to him, at once believes that they were originally in use, wore out, and were discarded. He files them and they show red metal. Consequently he believes that the castings are of good metal. The more ingenuity the unscrupulous scrap metal dealer displays in making the castings in forms that will serve to indicate that good metal had been used in them, the more the brass founder will be deceived. The discovery of this method of making "scrap composition castings" leads one to believe that "all is not gold that glitters."

Notes on Silver Plating German Silver Flat-Ware.

By William Wright.

In The Brass World, Feb. 1911, page 55, appears an article by Professors McWilliam and Barclay of the University of Sheffield, England, on the peeling of heavily silver plate flat-ware, such as that used in hotel, restaurant or steamboat service.

The conclusion reached was that 18 or 20 per-cent German-silver, heavily plated ware will peel in service when hard usage is given it. Now I will say, in expressing my opinion, based upon a number of years experience and observation, that the higher the percentage of nickel in German-silver, the greater the hardness and an increased possibility that the deposited silver will not adhere as firmly as on a German-silver containing a lower percentage of nickel. To overcome this, the finish of the surface and the preparing process for plating must be changed accordingly. The surface must be a dead sand-buffed finish, and not the highly polished condition. In addition, in the preparation of the flat-ware for the plating, after thoroughly cleaning it from grease, dip into an extra strong acid dip. The object of this dip is that the surface of the German-silver is left in such a condition that the deposited silver will cling to the base and not peel. To render the deposit doubly sure, after the flat-ware has been coated in the striking solution, take out and rinse in water and scour with a bristle brush and pumice. Then rinse in water, potash, cyanide and the mercury dip and strike again and hang in the plating tank.

These directions are given upon the supposition that the dips and plating solutions are in the proper working condition. If they are not, it will make no difference how the flat-ware is treated. If the silver deposit does not peel or strip in burnishing, it will loosen and leave the German-silver base metal after being in use.

Another consideration in regard to the finishing of German-silver goods is that, before plating them with silver, the sharp edges should be removed because the extra heavy silver deposit is apt to be forced from the edges in burnishing it, and is then sure to break off while the flat-ware is in use.

Stripping Silver Plated German-Silver Flat-Ware With the Results of Some Experiments on the Subject.

Practically all flat-ware manufactured is made of German-silver and then silver plated. Very little brass is now used and only for the cheapest class of work. It is frequently necessary to strip such plated flat-ware, either in the process of manufacture, on account of imperfect work, or when old articles are to be replated, or to ascertain how much silver is on the ware. Although this method can be used for determining how much silver is on flat-ware, as will be subsequently explained, it is only approximately correct and gives too high results. When used, therefore, the amount of silver found on the flat-ware is always more than is actually on the goods.

To remove the silver from German-silver flat ware, unless one is familiar with the right method to follow, is not as easy as would at first seem. If an attempt is made to dissolve it off with nitric acid, either strong or dilute, the German-silver will always be found badly pitted after the silver has been removed. Varying the strength of the acid will not change its action and if the flat-ware is to be preserved (and it always is) its use is out of the question. The same is true of removing the silver by making the flat-ware an anode in a cyanide solution. While the silver is removed, the German-silver is attacked and pitted. This method, too, is of no value. What is necessary in the removal of the silver from the German-silver flat-ware is a method that will remove it completely and yet not have any appreciable action on the German-silver itself. As far as known, there is only one method by which this can be done and this is by the use of a strong sulphuric acid strip containing a small quantity of nitric acid.

Before going into the matter further, let some history on the matter be cited. One of the first articles on the subject was that of Roseleur who, in 1872, gave directions for stripping the silver from brass, copper, German-silver etc. His method consisted in taking 10 parts of strong sulphuric acid and 1 part of nitric acid and using cold. While this strip works all right as far as the removal of the silver is concerned, it contains too much nitric acid and the German-silver, brass or copper are pitted. If, however, less nitric acid is used, the base metal is attacked so little that the German-silver spoon, fork or other piece of flat ware will come out of the strip, when the silver has been removed, practically as smooth as it went in and without any indication of pitting whatever. The following has been found a safe and excellent strip and is extensively used:

Silver Strip for German-silver, Copper, Bronze and Brass.

66° Sulphuric Acid ..... 1 gallon
38° Nitric Acid ..... 2 oz.

The acids should be pure and free from chlorides. The use of the chemically pure acids is recommended. The nitric acid is first poured into a stone crock and then the sulphuric acid poured into it. The amount of

Spoons Before and After Stripping.

nitric acid used is so small that there is no heat developed. The strip is used cold unless more rapid work is desired, and in this case it is warmed up. The cold solution, however, works well and requires no attention. When

used, the bother of heating is avoided and the results are apt to be better. The use of the cold solution is advocated as the stripping is then greatly simplified. The stripping of a tea-spoon containing the average amount of silver will usually take from 3 to 5 hours, but as no attention is required and as the spoon will not become pitted if left in over night or even longer, the advantage of the cold solution is readily understood.

To strip the silver plated flat-ware, it should be first cleaned from oil or grease to allow the action to take place evenly, and is then hung in the stripping solution by means of copper wire. The action commences at once and the surface of the silver immediately becomes dull. The action then goes on without interruption. A singular phenomenon will now take place. Just before the silver is completely removed and the German-silver left bare, the surface will turn purple. As there are some portions of flat ware that have more silver on than others, the thinnest portion is removed first and it is here that the purple color is first seen. In a short time, however, this purple color disappears and the dark, gray color of the German-silver underneath is revealed.

When all the silver has been removed from the flat-ware, the surface takes on a dark, gray appearance which is quite conspicuous. It is easy to ascertain when all the silver has been removed by the change in color. In the illustration is shown a German-silver spoon that has been silver plated and after stripping. The silver remains quite white in the stripping solution until the very last and even the last speck can readily be distinguished. It is easy to determine, therefore, when all the silver has been removed.

When removed from the stripping solution, the German-silver has a dark gray and rough appearance. It should be rinsed well and then dried when it will be readily noticed that the surface is covered with a slight deposit. This deposit readily brushes off or even may be wiped off so that when it is thus removed the metal is bright and smooth without any indication of pitting. If the flat-ware is to be re-plated, it should be first scratch brushed in order to remove the deposit in the background of any fancy design, and then buffed or scoured in the usual manner.

Brass, copper, bronze and German-silver may all be stripped in the solution with equally good results, but steel or iron is best stripped by backing off (i. e. using as the anode) in a silver plating solution. Cyanide does not attack iron or steel so that the silver is removed easily.

One of the old methods of stripping silver from German-silver, copper or brass was to add a small quantity of saltpeter to sulphuric acid. The saltpeter (potassium nitrate) is decomposed by the sulphuric acid and nitric acid is set free so that the result is the same as though nitric acid were employed in the beginning. As the use of the nitric acid is attended with accuracy, it is to be preferred to the saltpeter. The results are the same, of course, but for uniformity and certainty the mixture of sulphuric and nitric acids leaves little to be desired.

One thing should be borne in mind and that is that the flat-ware or other articles to be stripped must be *dry*, and water must be kept out of the stripping solution. It works well when strong, but if water is introduced into it, the German-silver will be pitted.

Experiments.

As it was desired to know whether the stripping solution acts upon the German-silver sufficiently to prevent the use of the method for estimating the amount of silver on flat-ware, some experiments were carried out.

In the first place, it was considered advisable to ascertain whether strong sulphuric acid alone, when used in the cold, would act on the silver enough to remove it. To this end, a silver plated German-silver tea-spoon was carefully weighed and then immersed in 66° strong sulphuric acid (chemically pure). The spoon was allowed to remain in the acid for 5 hours. It was then rinsed, dried and weighed again. The polish of the silver was scarcely altered, indicating that there was little action. The results obtained were as follows:

Spoon before immersion 32.1843 grams
Spoon after immersion 32.1818 grams

Loss ..... .0025 grams=0.008%

It can be understood, therefore, that the action of strong sulphuric acid, when cold, is exceedingly small.

To ascertain the amount of the action of the acid strip on the German-silver, two 18% German silver spoons were taken. One was a teaspoon and the other a table spoon. They had no silver on them. They were then buffed and thoroughly cleaned, after which they were weighed. They were then plated with a silver deposit in the regular manner and were then

burnished down and buffed. The spoons were again weighed in order to ascertain the amount of silver on them. They were then stripped in the usual manner with the cold strip composed of 1 gallon of strong sulphuric acid and 2 oz. of nitric acid. The stripping took about 4 hours in the cold. The spoons were then rinsed, dried and weighed. It was found that the action of the stripping acid is such that the spoons were attacked to quite an extent; so much so, in fact, that it would hardly be called a *safe* method for the estimation of the silver on the goods. The results obtained were as follows:

Tea Spoon.

Weight before stripping ..	30.1476 grams
Weight after stripping	30.0941 grams
Loss	.0535 grams

The amount of silver on the spoon was 0.7363 grams so that were it to be estimated in this manner, it would be about 7% too high.

Table Spoon.

Weight before stripping ..	53.0300 grams
Weight after stripping, ...	52.9631 grams
Loss	.0669 grams

The amount of silver on the table spoon was 1.2680 grams so that were it to be estimated in this manner, it would be about 5% too high.

It will be appreciated, therefore, that while this method will answer for estimating the amount of silver on German-silver flat ware provided only *approximate* results are desired, it cannot be called an accurate process, and should be employed only when ordinary results are desired. It answers well, however, for removing the silver from the base metals, and while it attacks the German-silver, copper or brass to a slight extent, it does not pit it and leaves the surface in nearly as good condition as it originally was before plating.

In order to find out how a prolonged immersion in the stripping solution would act, a tea-spoon from which all the silver had been previously stripped, was immersed in the stripping acid previously mentioned. The results were as follows:

After 2 Hours Immersion.

Weight before immersion	30.2662 grams
Weight after immersion ..	30.2190 grams
Loss	.0472 grams

After 24 Hours Immersion.

Weight before immersion	30.2662 grams
Weight after immersion ..	30.1298 grams
Loss	.1364 grams

The loss, therefore, after 24 hours immersion, was about 0.45%. Although the German-silver spoon was immersed in the stripping acid for 24 hours (in the cold), the surface was not pitted and by scratch brushing and buffing was again fit for plating. The action of the stripping acid seems to be very even It is a singular fact that even though the sulphuric acid has practically no action on the silver,the addition of a very small quantity of nitric acid causes the strip to act. The action seems to be more than that of the actual nitric acid used, for it may be used for a long time without the need of adding any more nitric acid.

Correspondence.

The Early Use of German Silver Flat-Ware.

Editor:—

After reading the article in THE BRASS WORLD, March 1911, page 92, entitled "Looking Backward in the Plating Industry", I am tempted to offer the following:

The first German-silver spoons and forks were made by Cope of Faziley St., Birmingham, England between the years of 1855 and 1858, and it was also used in the manufacture of rosettes and other articles employed in the saddlery hardware trade. Such ornamental articles were punched out on presses.

The German-silver was furnished by Evans & Askin of Birmingham, England, and if my memory serves me right Dr. Evans was the first* to produce metallic nickel and the first manufacturer of German-silver. As I was a boy at that time and had occasion to have a knowledge of the fact, I think I am correct.

John Morris.
Waldron & Morris,
Philadelphia, Pa.

Next to imperfect cleaning of work to be electroplated, the use of dirty rinse water is the most frequent error in plating. It is responsible for many of the poor jobs of electroplated work turned out.

*Nickel was discovered by Cronstedt in 1751.

Specifications for Automobile Alloys.

The Society of Automobile Engineers, which comprises the engineers of the leading automobile manufacturers in the United States, has recently issued a *preliminary* report of the various non-ferrous alloys used in automobile construction. These specifications are not final and they say are for discussion only. The discussion which will follow may result in change, but the following are the specifications given:

Babbitt Metal.

Tin	84.00%
Antimony	9.00%
Copper	7.00%

The babbitt-metal must contain no other elements than tin, antimony and copper. Any alloy containing more than traces of other metals will be rejected. A variation of 2% either way will be permissible in the tin. A variation either way will be permissible in the antimony and copper. The use of other than virgin metal is prohibited. No impurity will be permitted other than lead and that not in excess of 0.10%.

White Brass.

Zinc	28.00% to 30.00%
Copper	3.00 to 6.00%
Tin	65.00%

Any shipment containing more than appreciable amounts (0.10%) of other metals may be rejected.

Phosphor-Bronze Bearing Metal.

Copper	80.00%
Tin	10.00%
Lead	10.00%
Phosphorus	0.05% to 0.25%

A tolerance of 1.00% plus or minus will be permitted in the above percentage, except phosphorus. Iron and zinc in excess of 0.10% will not be permitted. Antimony should not exceed 0.10%.

Brass Casting Metal.
(Composition.)

Copper	84.00% to 86.00%
Tin	5.00%
Lead	5.00%
Zinc	5.00%

In connection with the percentages of tin, lead and zinc, a plus or minus tolerance of 1.00% is permissible.

Yellow Brass.

Copper	62.0% to 65.0%
Zinc	36.0 to 31.0%
Lead	2.0 to 4.0%

Iron in excess of 0.50% will not be permitted.

Cast Manganese Bronze.

Manganese bronze is understood to mean a metal constituted principally of copper and zinc, in the proportion of 60 to 40, iron being present in small percentages. Manganese may or not be present; sometimes a trace and sometimes in small amounts. Main dependence will be placed upon physical specifications, which are as folows:

Tensile Strength.. 60,000 lbs. per sq. in.
Yield Point ..... 30,000 lbs. per sq. in.
Elongation in 2 in. 20%

Aluminum Alloy No. 1

Aluminum not less than 90.00%
Copper ..... 7.0 % to 8.5%

Total impurities shall not exceed 1.5% of which not over 1.0% shall be iron, and not over 0.5% silicon. No other elements than carbon, silicon, iron and manganese shall be permitted.

Aluminum Alloy No. 2.

Aluminum, not less than	80.00%
Zinc not over	15.00%
Copper, between	2% and 3%
Manganese, not to exceed	0.40%

Total impurities shall not exceed 1.65% of which not more than 0.50% should be silicon, not more than 1.00% iron and not more than 0.15% lead.

Aluminum Alloy No. 3.

Aluminum	65.00%
Zinc	35.00%

Notes and Instructions on Foregoing Specifications.

The grade of babbitt metal mentioned is used on account of the large amount of copper it contains. It is hard and strong and resists punishment which it is sure to have in automobile engines.

White brass gives good results in automobile engines, but no better results as a rule than geniune babbitt. Provision should be made to have it thoroughly lubricated.

The phosphor bronze is similar to that specified by many of the large railway systems for car bearings. It is an excellent composition where good anti-friction qualities are re-

quired. It should be used only against hardened steel in automobile construction.

The brass casting mixture here specified (commercial composition) is used for light castings and possesses excellent machining qualities.

The yellow brass alloy represents a high grade of yellow brass casting. Commercial yellow brass castings are, generally speaking, a miscellaneous assortment of mixtures, some of them containing considerable amounts of iron (for 1% to even 3%) which is very undesirable as it renders the castings liable to blowholes, hard spots and, in some cases, small particles of metallic iron. The alloy given possesses good machining qualities and is tough.

Manganese-bronze is of much value for castings where strength and toughness are required.

Aluminum Alloy No. 1 is the highest of all the aluminum alloys possessing sufficient degree of strength, an alloy containing less copper being very weak and open grained. This metal can be used where lightness and toughness are required throughout an automobile.

Aluminum Alloy No. 2 possesses good strength, closeness of grain and can be cast solid and free from blowholes. It is a light metal, its specific gravity being in the neighborhood of 3.00.

Aluminum Alloy No. 3 is a mixture that can be used where cheap castings, not subjected to any great strains are desired. It is a desirable mixture for such castings as flat plates, foot-boards, running boards and the like. It has good strength but it is quite brittle and does not possess the life or toughness of Aluminum Alloy No. 1.

The use of a block of wood on the top of molten brass in a crucible, when pouring is taking place, serves to protect the metal from oxidation and partially prevents the ingress of dross into the mold. The block burns and gives a reducing atmosphere. This practice has been found to give excellent results and is used in some of the brass rolling mills. The block, which should be of wood which will not snap when burning, is thrown on the surface of the metal after skimming and just before pouring.

Some Unsolved Problems in Electroplating.*

By George B. Hogaboom.†

There has existed for a long time a separation of the practical plater and the electrochemist, that it is a pleasure to present this paper, as suggested by your secretary, and it is hoped that the practical end of electroplating, as represented by the National Electroplaters' Association, and the scientific end as represented by this Society, will be brought into a closer relation. As is well known, electroplating was the beginning of the science of electrochemistry, but it has lingered by the wayside and been neglected as a science, and to-day the unsolved problems are many.

Electroplating has been looked upon more as a trade than a science, and it is only during recent years that much study has been given to it by scientists, and that attention has been directed more to the electrolytic refining of metals than to the deposition of metal for decorative purposes. The solutions published by Roseleur in 1854, have been improved upon but little, and those who have published treatises upon the subject often give only a repetition of his formulas. Nickel plating, as invented by Dr. I. Adams, is probably the only exception.

The field is broad, but its development has been left to the practical man, guided only by the rule of thumb. An electrochemist in the plating room of a fatcory is so rare that it probably can be said without fear of contradiction that they can be counted on the fingers of one's hands. The need to-day is mutual assistance in solving these problems and the developing of new ideas. To a great extent they are "useless without each other"—the plater producing results which he cannot duplicate—the electrochemist creating solutions that are not a commercial success.

So many phenomena have been encountered that to include the perplexing problems would necessitate a history of nearly every known solution and finish. The varying of the temperature and the electric current often prove

*Paper presented at the meeting of the American Electrochemical Society, held in New York City, Apr. 6-8, 1911.

†Secretary National Electroplaters' Association.

a stumbling-block, and these conditions cannot always be controlled. There is a vast difference between producing a homogeneous deposit at a minimum cost from a solution where the amount of cathode surface is being changed every twenty minutes, and a solution in which the amount of cathode surface is always the same and the rapid deposit of the metal is more desired than a deposit that can be easily burnished. Such would be the difference, for instance, between the surface of a sheet of electrolytic copper and that of a cast lead and antimony electrolier with its deep reliefs and where a coarse crystalline structure would destroy its beauty. In the discussion of electroplating problems, it must be borne in mind that a mere deposit of a metal is not all, but that the deposit must be soft and smooth and lend itself to a decorative process; the anodes should be capable of being reduced easily; the electrolyte must offer little resistance to the electric current, and, last, but not least to the plater, who hears it so often that it becomes a part of him, the cost must be nominal.

The automobile industry has brought about more than anything else, the need of a heavy deposit of brass. At present this is done in a solution of cyanide of copper. The deposit is not only slow, but unsatisfactory, because of what is known as "spotting out"—a discoloration in spots which appears on the work after it has been polished and lacquered. Deposits on cast metal give the most trouble. It is probably caused by the acids or alkaline solutions being absorbed in the pores of the metal, or in the small blow-holes, and the deposit covering these holes partially, leaving minute holes through which the solution oozes out. Several remedies have been suggested and tried, such as boiling out in some neutralizing chemical solution, placing in a drying oven for several days, but a satisfactory remedy has not been found.

An acid brass solution would be a great advantage. There is an acid copper and an acid zinc solution, but no acid brass electrolyte. The difference betwen the deposit from a cyanide and a sulphate of copper solution well illustrates the advantage of having an acid brass solution.

Tin.—The formula for a tin solution published by Roseleur is the most generally used today, as little, if any, improvement has been made upon it, although a good solution which would give a heavy deposit is much desired. In Roseleur's solution the electrolyte is not replenished by the anode, but by the constant addition of a concentrated solution. This should be overcome, and would be appreciated by manufacturers of tinware.

Aluminum.—While several solutions have appeared from time to time for plating upon this metal, none of them are in general use, and a good electrolyte that would deposit gold, silver, brass or copper so that it would stand burnishing and not peel off in time could be used.

Nickel.—The successful removal of a deposit of nickel from another metal without affecting the latter has not been accomplished.

To give all the unsolved problems in detail would make a lengthy paper, and a simple statement of those most desired will be given:

An electrolyte that will remove the fire-scale from brass; also one that will produce a bright or a matte surface in place of using the present acid dips.

An electric cleaner that will saponify the grease and take it into solution instead of driving it to the top, where it has to be constantly removed to prevent it from adhering again to the work as the latter is removed from the solution.

A heavy deposit of lead on the inside of iron pipes, to prevent rapid corrosion.

A method to coat electrogalvanized iron or steel with decorative metals without destroying the rust-resisting properties of the zinc.

An alkaline nickel-silver solution that can be worked with a low voltage.

A method of etching steel without destroying a resistance film of gelatine.

Some alkaline substance that would replace cyanide of potassium. This would be universally welcomed.

For the above suggestions, the writer is indebted to 100 different platers, who were kind enough to answer a request for unsolved problems. It may be interesting to note that 80 per-cent of them requested an acid brass solution.

Economizing on nickel anodes is bad practice. In electroplating, the nickel must be obtained from some source, and if the anodes do not supply it, it must be introduced as nickel salts. Salts are always more expensive than anodes when the actual nickel in them is taken into consideration.

The Right and Wrong Shape of Stirrers Used in Brass Melting.

Many brass founders seem to have the idea that all that is necessary in stirring brass or other metals while melted in a crucible is to use an iron rod. Anything that can be handled is considered suitable. This belief is quite wrong and not only does the shape of the stirrer affect the proper mixing of the metal, but the crucible suffers when it is badly made. If brass founders would use a stirrer of the right shape, they would have less difficulty in the production of good castings. To be sure, it will not solve all the problems of the brass foundry, but it will assist in overcoming them.

Fig. 1. Bad Form of Stirrer Often Found in Brass Foundries.

In Fig. 1 is shown a stirrer often (quite often) found in brass foundries. It is simply a 1 inch iron rod. When first made, the rod is cut off to the right length and nothing more is done. Soon the metal, acting upon the iron, begins to dissolve it and after having been in use for a long time it has the appearance shown in Fig. 1. It is not infrequent to find that the rod has worn down to a sharp point.

The objection to a stirrer of the kind illustrated in Fig. 1 is that it does not stir or mix the metal properly, and it is apt to injure the crucible. In stirring metal, it is impossible to use the stirrer without actually touching the bottom of the crucible, and in the right method of stirring, the metal is "churned" by moving the stirrer up and down so as to mix in the most thorough manner. When a stirrer of the shape shown in Fig. 1 is employed, the bottom of the crucible is usually more or less injured and it is frequently attacked to such an extent that it begins to leak. In Fig. 2 is shown a crucible which has been injured in the bottom by the use of such a stirrer.

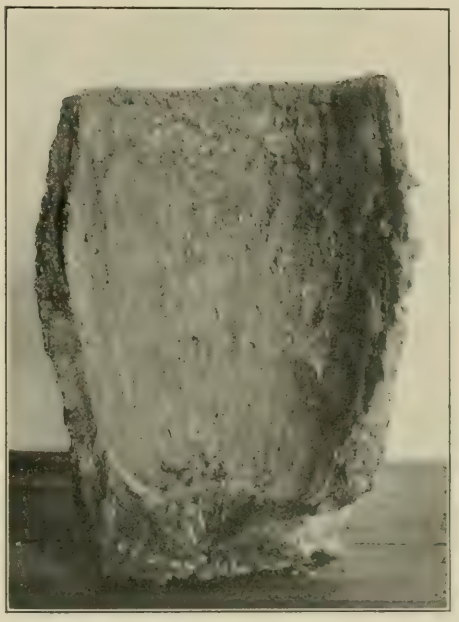


Fig. 2. Bottom of Crucible Injured by Stirrer Shown in Fig. 1.

The right form of stirrer is that shown in Fig. 3. It need not necessarily be of the exact shape shown, but the idea is to have a knob on the end. This serves to bring up the metal in the bottom of the crucible and also to prevent injury to the bottom of the crucible.

When a knob is used on the bottom of the stirrer, the rod need not be as large as otherwise as it can be handled better if not too heavy and the knob portion does the stirring. A rod about 1 inch in diameter is generally

employed and the knob formed either by upsetting the end or welding on a larger piece of round and then forging down. This part, however, is readily carried out by a competent blacksmith.

Stirrers should always be made of the best wrought iron. Norway iron is excellent, but any good grade of refined iron will answer. The common grades of commercial iron do not work as well as they are more apt to break in service or wear away more rapidly.

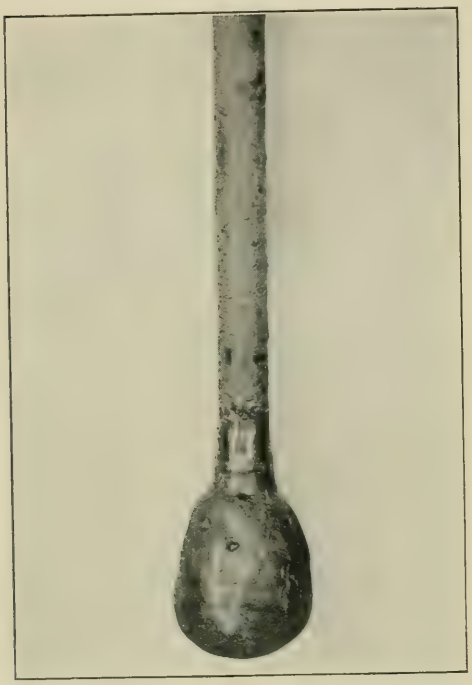


Fig. 3. Right Shape of Stirrer.

Soft steel is quite unsuited for this purpose as it lasts but a short time and frequently breaks while hot.

In conclusion it may be said that the form of stirrer shown in Fig. 3 is the type used in the brass rolling mills of the Naugatuck Valley, Connecticut and has been found satisfactory. Wrought iron is always used.

Slivers on rolled metals are caused by the cracking of the metal during the first rolling operation. When the metal is further rolled, the cracks overlap at the edges and finally become slivers.

The Electrolytic Corrosion of Electroplated Objects (Writing Pens.)*

By Walter S. Landis.

For several years past the author has been using a certain well-known brand of steel writing pen with great satisfaction. The demand made upon the pens is not severe, they being used only for signatures, corrections and such occasional writing, though being moist with ink for several hours at a time. Under such light and easy service the life of the pens was always at least a week, and frequently several weeks elapsed before they reached that scratchy stage demanding replacement.

This past winter, on attempting to purchase a fresh supply of this old, reliable brand, it was found that the local stationer did not have the plain steel ones in stock, but could furnish the same style and brand gold-plated. The cost of this plated pen was about one-half more than the plain steel ones. Thinking that the manufacturer had improved the life of the pen by this plating, a box of the new style was purchased. In use under practically the same service that the plain steel ones had been subjected to, the plated variety lasted rarely more than two days. The corrosion of the points and between the nibs was excessive, one pen frequently not writing more than five hundred words before requiring replacement. The life of the pens being so very short, I determined to make an investigation of the cause. The results of this investigation are here produced.

Microscopic and chemical tests showed that the pens were probably first copper-plated and then flashed with gold. The total thickness of the yellow metal coating was 0.006 mm., and the pens carried approximately 0.25 milligram of gold each. The plating was excellently done and was absolutely continuous as far as could be ascertained by chemical test. The pens could be thrown into sulphuric acid and left there for some time without loss of weight. I therefore came to the conclusion that the corrosion was electrolytic in its nature, and formulated the following hypothesis to account for it: The friction of the pen point

*Paper read at the Meeting of the American Electrochemical Society, New York City, Apr. 6-8, 1911.

on paper rapidly wears off the plating on the point, thus exposing the steel. An electrolytic couple, *Steel—Ink—Gold*, is set up and corrosion of the steel takes place with great rapidity.

Some idea of the electrochemical nature of this couple may be gained from the following: A pen was stripped of its plating by an 18-hour immersion in strong potassium cyanide solution. This stripped pen and a plated pen were then connected in series with a high resistance voltmeter and the two pens dipped into various kinds of ink, contained in a small cell about the size of a thimble. A potentiometer was not available at the time the experiments were made, so that I had to content myself with measurements made on closed circuits of 300 to 500 ohms' resistance

When the two pens were dipped into "Barnes' National Jet Black Ink," the voltmeter showed a reading of 0.045 volt at once, dropping in three minutes to 0.020 volt, and in five minutes to 0.015 volt, at which point it remained constant for some time. When taken out and redipped, the whole series repeated itself. Vibration of the pens, while immersed, gave a continuous reading of about 0.045 volt. The resistivity of the ink was approximately 112 ohms per cm. cube. Index of corrosion, 0.00040.

In "Stafford's Universal Writing Fluid," the series was 0.08, 0.02 and 0.008 volt; vibrating the pens maintained a constant electromotive force of 0.022 volt. The resistivity of this ink was 68 ohms per cm. cube. Index of corrosion, 0.00033. In a rather old and faded brand of this ink, the reading under vibration of the pens was 0.016 volt. No measure of the resistivity of this faded ink was made.

In "Waterman's Ideal Ink," the series was 0.088 and 0.040 volt. A steady electromotive force of 0.120 volt could be maintained by vibrating the pens in the ink. The resistivity of this ink was 68 ohms per cm. cube. With a freshly stripped pen against a fresh gold-plated one, a similar result of 0.12 volt was measured. Index of corrosion, 0.00176.

These experiments seem to corroborate my original hypothesis as to the cause of the excessive corrosion of the pens. When in use, the continual dipping of them into ink and the vibration occasioned as they rub over the paper maintains a short-circuited couple with the maximum electromotive force noted, and causes consequent corrosion of the steel point as the anode of this couple.

The "index of corrosion" as given above for the various writing fluids is the product of the maximum electromotive force found for the vibrated pens multiplied by the conductivity of the various inks. This index assists in choosing the least corrosive ink in case the plated pens have to be used.

While the corrosion of the plated pens is not a matter of great commercial importance, yet there is to be gained from the experience a certain wholesome lesson on the application of electroplating to the protection of less noble metals: *Do not plate with a nobler metal a material that is likely to be subjected to wear on one spot and which spot is to be moistened with liquids.* For, as soon as the plating is worn through on that spot, accelerted corrosion will take place, and in the end the resulting corrosion will be far worse than without the plating.

The "Original" Babbitt-Metal Formula.

The discovery that soft metal makes an excellent bearing surface, belongs to Isaac Babbitt of Boston, Mass., who patented his invention in the United States July 17th, 1839 (No. 1252). Since that time the use of soft metals as bearings has grown until to-day more is employed than ever before.

It is an erroneous idea that Isaac Babbitt patented the actual white metal mixture itself. His patent was upon the *use* of a white or soft metal in bearings. While he did not claim any particular metal mixture, he recommended the use of the following:

Tin	50 lbs.
Antimony	5 lbs.
Copper	1 lb.

This mixture is somewhat softer than that now employed as "Genuine Babbitt-Metal" as it has been found expeditious to use more copper in order to obtain a harder metal.

Small test bars always give a higher tensile strength per square inch than large ones on account of the rapid cooling of the small bar in the mold.

Good castings do not depend upon the mix ture of metals composing them, but upon foundry practice. With the right foundry practice good castings may be made of any mixture of metals.

Brass Rolling in the United States.

At a meeting of the Birmingham Section of the Institute of Metals on February 14, Mr. G. A. Boeddicker, the chairman, read a paper on the above subject in which he recorded the impressions he formed during a recent visit to various metal works in America. He found the works well up to date. Electric driving was generally adopted except for rolls, and the power stations were well built. The only boiler met with was the Babcock & Wilcox water-tube boiler, and the engines were all slow running. Rolls were generally driven from a jack-shaft, a convenient arrangement whereby any number of rolls could be put side by side without their being coupled together. That enabled the speed of the different rolls to be varied as required, while a break-down of one or another did not interfere with a whole train. Where that arrangement was adopted the engines were running from 75 to 100 revolutions.

The Castings and Furnaces.

Great care was taken everywhere in using only pure metals for the alloys made. The copper used was mostly Calumet and Hecla. The spelter was of exceptional purity, containing 0.4 to 0.1 per cent. of lead, and even if the alloy produced should contain lead only pure spelter was used and pure lead added to the alloy. The casting was done on a large scale; but it was probably not quite so well done; owing to the fact that there being no casters' lads employed, labourers, without experience, were sometimes put to the casting of German silver and brass.

The furnaces were mostly of the round type; the fuel anthracite, and, generally, 160-lb. pots were used, the metal being cast into ingots of 75 to 100 lbs. For narrow metal the ingots were 6 in., while for sheet metal they were 12 in. wide. In pouring, a small funnel was put on the top of the mould. It was lined with fireclay and had four holes in the bottom to split the metal. All slag and charcoal remained in the funnel and could not get down into the mould. A similar plan was used in casting rods. These were sometimes cast into split moulds and sometimes into solid moulds. Where the latter were used they were open at the bottom and fitted with a plunger about 6in. long. When the rod was poured and had set, but while still red hot, the plunger was pushed up 4 in. or 5 in.; that pushed up the rod and there it was left until quite cold when it could be readily lifted out of the mould. The Americans went to great trouble and expense in cleaning the surface of the ingots before rolling. Sometimes they were scraped all over on a "scalping" machine, and sometimes they were planed, in which case a shaving ⅛ thick would generally be taken from each side of an ingot 1¾ in. thick, which meant about 14 per cent. of scrap from one operation alone. He felt thankful that the scalping process was avoided in British practice.

The Rolling and Wire Mills.

The rolling mills were generally speeded up. At Waterbury they "broke down" at 10, "got down" at 22 and finished at 45 revolutions, while at the Riverside Mills they broke down at 20 and finished at 50 revolutions. As a result of that speeding up a pair of rolls probably got through two or three times as much work as would be the case in this country. The rolls were fitted with automatic coiling arrangements for coiling the strip as it was rolled. That was rendered necessary by the length of the strips, which would otherwise be too long for the annealing furnace. The annealing was done in oil-fired open furnaces, sometimes at the same temperature as in this country and sometimes at much higher temperatures. The metal was conveyed from the rolls to the muffle on a tray and lifted bodily into the furnace by a simple pulley arrangement, the operation taking only a few minutes. A charge of 20 to 30 cwt. would be left in the furnace for an hour or an hour and a half. Narrow strips were not put in flat, but were placed on edge sideways between pegs riveted on the tray so that no two strips touched each other. When the metal was withdrawn from the furnace it was instantly quenched by a jet of water. The annealing furnaces measured about 6 ft. by 15 ft.

The gang slitters and shearing machines were fitted with automatic scrap-cutting devices. There were pickling brushing and drying machines and overhauling machines for thin strips, where the metal passed over several rollers and where one man inspected one side and another man the other.

In the large Waterbury wire mills, the wire was transported from the blocks to the annealing furnace and from them to the pickling

shop and back again to the blocks by means of overhead electric trolleys. Apart from bull blocks, continuous machines of the Waterbury type were general throughout America. The English system of rolling bars, slitting them, and drawing the slittings was practically abolished and rod rolling had been introduced not so much for the sake of economy, as in order to get rods of 56 to 60 lbs. For pin wire, or any other wire down to 18 or 20 gauge which was not required in heavy coils, the English system was probably quite as economical as rod rolling. All the plant was electrically driven, and in one case the motors were placed beneath the floor and connected to the mills above by short belts. The annealing furnaces for rods were open cylindrical furnaces which could be conveniently charged from the electric trolley overhead.

In concluding his observations, Mr. Boeddicker said that many of the improvements he had noted were only advantageous where the quantities of material to be dealt with were large. They would probably be found impracticable in Europe, partly because the works were not large enough and partly because the orders received on this side were smaller and more diverse. Where the Americans dealt with four or five different qualities of German silver, European manufacturers had to deal with about twenty, and where the former got one order for 5 tons of one size and one gauge, manufacturers on this side would get, perhaps, a hundred orders for a hundred different sizes. It was, therefore, a mistake to assume, because British manufacturers had not more generally adopted Western ideas, that they were behind.

Discussion.

In the discussion following the paper, Mr. J. W. Earle said that he agreed as to the inferiority of American castings. This resulted either from the use of bad or rough iron moulds or insufficient care in scraping and dressing them. The thing that struck him most in going over some American mills, was the large number of costly subsidiary machines employed. They were so numerous and so important that the rolling mills themselves were almost lost amongst them. The lists of sizes issued by American manufacturers to their customers were of a more definite character than those used in this country and prevented customers from substituting thin and even thinner gauges for the various sizes.

Mr. Dugard said he had seen strip taken into the mills which would be promptly rejected in this country. As a rule it was put on the overhauling machine and even after it was scraped the spills sometimes remained; nevertheless they were able to produce good brass.

Mr. Bean (Allen Everitt & Co., Lim.) said that while British manufacturers at times made something verging on a profit, American mills were making 12½ per cent. and more profit every year. It was all a question of power and speed; quick and powerful machinery was the secret of their success. The high wages paid to operators by American manufacturers had not been an unmixed evil, for it had driven them to adopt the powerful labour-saving machinery of which they had heard. He had been struck by the splendid surface on American rolled metal and if that resulted from the use of the scalping machine he would be pleased to see such machines used in this country.—*The Ironmonger.*

Use of Silicon in Hydraulic Bronze.

According to S. Kern in the *Chemical News*, silicon may be used with good results in making castings of bronze for hydraulic purposes. He states that castings capable of standing high steam or water pressure may thus be produced. The mixture recommended is as follows:—

In a crucible capable of holding at least 200 lbs., 78 lbs. of copper are placed and 10 lbs. of brass. When melted, 12 lbs. of tin, 1.4 lbs. of zinc are added and then 0.12 lbs. of 10% silicon-copper. The whole is stirred and is ready for pouring. It is claimed that the silicon produces soundness. It will be noticed that the amount of silicon introduced is quite small (only about 0.01%) which is claimed to be ample for the deoxidizing.

Too much spelter in yellow brass causes dirty castings. The best results are obtained by the use of about 30 per cent. of the metal. When much over this amount, the results are not as good.

Blowholes in castings are always caused by the absorption of gas during the melting. As the casting cools in the mold, these gases are expelled with the formation of blowholes or pinholes. Pinholes are simply small blowholes.

Production of Asphaltum of High Sensitiveness for Photo-Engraving.*

By Prof. E. Valenta.

As obtained in the market, ordinary Syrian asphaltum has a comparatively low sensitiveness to light, and this has greatly hindered its use for production of pictures on stone, metal plates, etc.

For many years attempts have been made to increase the sensitiveness of asphaltum to light, and two different methods of attaining this object have succeeded. One of them consists of treating the raw asphaltum with ether, by which the less sensitive components are removed and the most sensitive remain. The other consists in the incorporation of sulphur by which the two less sensitive components are converted into the third really active. This method of sulphuration of asphaltum originated with me and consists in melting the asphaltum with the requisite quantity of sulphur or dissolving it in a solvent of high boiling point and heating it with sulphur in a return condenser.

The sulphuration of the asphaltum under these conditions is accompanied with copious evolution of hydrogen sulphide gas. The simple fusion of the asphaltum with sulphur is difficult to carry out without carbonizing it, consequently sulphurating by the wet method is preferable. Pseudo-cumol is used for dissolving the asphaltum and the solution mixed with 12 per cent. of sulphur in powder, and heated in a retort with an inverted condenser as long as hydrogen sulphide gas is given off. The solvent is then distilled off and the black residue is dissolved in 25 parts of benzol and used for the preparation of the plate for etching or lithographing.

When the operation is carried out with care, the asphaltum so produced is relatively very sensitive, but the preparation requires careful working otherwise it may happen that besides it an insoluble substance is formed. Moreover the asphaltum easily becomes burnt. These are the reasons why the sulphureted asphaltum has not come into such general use as it deserves on account of its high sensitiveness to light.

*From Penrose's Process Annual, 1911. Translated from the German by Major-General Waterhouse, I. A.

At the present time a good deal is being done in various reproduction establishments with asphaltum films. The asphaltum is usually purified in the expensive way with ether already mentioned, or unpurified. Many use it without purification. I have succeeded in working out a simple process for purifying and sulphurating the asphalt which gives reliable results and a relatively high sensitive product. In doing this, I started from the fact that many compounds containing hydrogen when heated with sulphur chloride, take up sulphur with disengagement of hydrogen, which combines with the chlorine of the sulphur chloride to form hydrogen chloride.

Carbon bi-sulphide is a suitable solvent for asphaltum. The process is carried out as follows:

A glass retort is charged with 100 grams of Syrian asphaltum in powder and dissolved in five or six times its bulk of carbon bi-sulphide. When disolved, 6 to 8 grams of sulphur chloride (4 to 5 c. c.) previously diluted with 20 c. c. of carbon bi-sulphide, are added in small quantities and the whole well shaken. The retort is then connected with a glass condenser provided with cork (not rubber) stoppers or connections, and about one-third of the carbon bi-sulphide distilled over.

The residue in the retort is then poured out into a large bottle and 2 litres of anhydrous benzol added. The whole is shaken and filtered, and is then ready for use. For lithographic purposes, about 2 per cent. of oil of lavender is introduced.

Comparison of films made with this treated asphaltum with those of chromated albumen, showed that the sulphuretted asphaltum came very closely to the latter in sensiteveness. *With three minutes exposure to the sun, under a line negative, developable images were produced.* The asphaltum images are developed with Neustadt turpentine with or without Russian oil, which has been found necessary with thicker films and consequently longer exposure.

Blisters on plated metals may be caused by the presence of grease on the surface of the metal being plated, or the use of too strong a current. When the surface is greasy and the current too strong blisters are quite apt to form.

Bronze Powders and Bronzing.

A Commission recently appointed by the British Government to inquire into the condition of the bronze powder and bronzing industry in England with reference to the health of the employees, have rendered their report.

They say, in their report, that bronze powders are made mainly in Nuremberg, Fürth and neighboring towns in Bavaria. They are not made in England and consequently they were not able to see the process

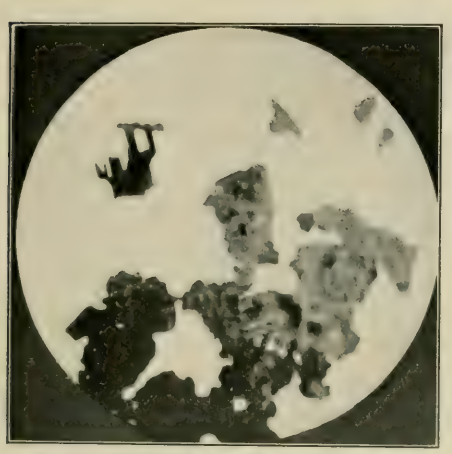


Fig. 1. Microphotograph of Coarse Bronze Powder.

of manufacture. They state as follows: "We are informed that the powder is produced from thin sheets of metal leaf by rubbing them through the meshes of fine wire sieves, and that the waste from metal leaf (Dutch metal) factories, in addition to new metal, is used for this purpose. After the addition of oil, the mixture is ground in suitable machines to the requisite degree of fineness; the greater part of the oil is then extracted by placing the mass in water and then subjecting it to strong pressure."

Several analyses of bronze powders were made in the Government laboratory and the following results were obtained.

Aluminum Powder.

Aluminum	99.03%
Impurities	0.64%

Silver Powder.

Zinc	77.04%
Aluminum	21.53%

Gold Powder.

Copper	70.02%
Zinc	29.64%
Lead	.05%
Arsenic	0.05%
Iron	0.24%

Bronze Powder.

Copper	84.82%
Zinc	14.85%
Lead	trace
Arsenic	.06%
Iron	.27%

The green, pink, violet and other colored powders are the regular bronze powders colored with analine dyes. The largest consumers of bronze powders are the lithographers.

The investigation indicated that bronzing machines are now supplanting hand bronzing and with the accompanying safety of the operatives. Bronze powder inhaled does not have the bad effect of emery or steel dust

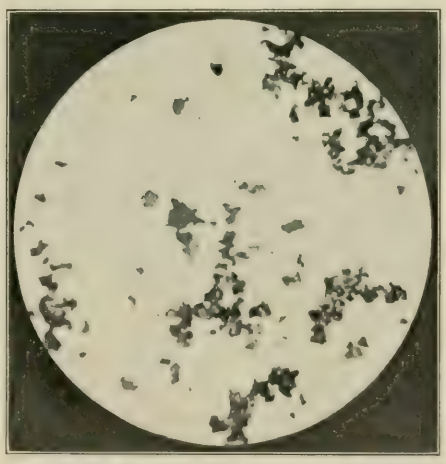


Fig. 2. Microphotograph of Fine Bronze Powder.

from grinding operations and is not apt to bring on pulmonary troubles like them. The dust is not sharp as they are and does not penetrate the muscles of the throat. The effect of bronze powders is more of copper poisoning than that of dust. As evidence of the absence of sharp particles, microphotographs of bronze powders (herewith reproduced) were taken.

The only method of cleaning antimonial-lead, britannia-metal or pewter for plating is by scouring it. There is no dip that can be used for the purpose.

Use of Agitated Plating Solutions in England.

At a meeting of the Sheffield Electro-Metallurgical Society, Mr. G. Bernard Brook, Lecturer in Preparatory Non-ferrous Metallurgy, read a paper on Mechanical Aids to Electro-Deposition. The subject was divided into three heads, as follows: (1) The effects resulting from agitation of the electrolyte; (2) various types of mechanical agitator; (3) the laboratory application of the same principles to electro-chemical analysis. He said the demand for the cheap electroplating of certain classes of manufactured articles in which the end sought had not been so much one of appearance as the counteraction of atmospheric corrosion, had led to the use of agitated electrolytes or rotary cathodes to shorten the time required for plating, and in the case of small articles, like cycle accessories, by some of the systems in which the cost of wiring is entirely dispensed with. The advantages obtained by agitation were enumerated. First of these was uniformity of deposit, as an even thickness of deposit was found equally on the parts nearest the anode plates. This tendency to thicken their deposits was more noticeable in nickel and similar neutral baths than in the silver and copper cyanide solution. The relatively poor conductivity largely accounted for this result, as was reflected in the fact that hitherto the rotary plating method had been largely confined to the refractory metal nickel. Freedom from burning was also secured by agitation, which reduced the chance of occlusion of hydrogen by the deposited metal, which, in the lecturer's experience, had rendered nickel deposits so hard to the ordinary polishing agents. Another advantage of agitation was increased output, since the current could be increased proportionately to the rate of movement, time was saved in wiring, and the deposit was so bright that for some purposes it required no subsequent polishing. Mr. Brook expressed the opinion that Mr. Sherard Cowper Coles' system of revolving cathodes represented the acme of refinement of rotary deposition, as it gave the maximum rate of deposit, combined with the advantages of centrifugal filtration, uniformity of composition of the electrolyte, and from the nicely calculated rate of speed at which the cathode revolved resulted in a deposit having an almost burnished surface. Describing revolving electrodes as used in electro-chemical analysis, Mr. Brook stated that this laboratory process grew out of the use of plating barrels in works practice, and not *vice versa,* as was usually the case.

Professor Arnold, who presided, congratulated Mr. Brook on the valuable information contained in his paper, and as bearing out what he had said about the occlusion of hydrogen by metals, stated that in the course of experiments at the University of Sheffield it was found that after pickling nickel steel sheets in acid they became so brittle that they could be broken like tinder; but if they were heated to a dull red subsequent to the pickling their original tenacity was secured, this condition being induced by the occlusion of hydrogen by the steel. Discussing the question of electrolytically deposited copper tubes, Professor Arnold said he would like to know if the great purity secured did not reduce the ability of the metal to withstand certain strains when in use. He was of opinion that the small percentages of impurities in commercial best copper to some extent gave the metal the high value it possessed under alternating stresses.—*The Ironmonger.*

Non-Metallic Composition for Making Patterns and Match-Plates.

John Bayer of Cleveland, Ohio, has recently patented a composition for making patterns and match plates which he claims is very satisfactory. It is made of the following materials:

Trinidad Asphalt	73 lbs.
Plaster of Paris	25 lbs.
Plumbago	2 lbs.

The ingredients are melted together and stirred. The inventor says:

"Such a composition of matter is found to possess the following properties: It is fusible at a rather high temperature to a viscous consistency; it will make a good sharp casting though without appreciable change in volume upon solidification; it will not shrink perceptibly upon cooling; when cold it is solid, and so tough as not to be easily broken and at the same time hard enough to resist deformation under any reasonable or ordinary stress; it possesses a smooth, dense, wear resisting surface which forms a clear cut mold

and can be used over and over without blunting and rounding off sharp corners; it is unaffected by any such reasonable and ordinary degrees of temperature as devices of this class are subjected to; it is rather light for its bulk and easily handled; small breaks and fractures can easily be repaired by a process of soldering with the same material, and it can be remelted and used over and over again."

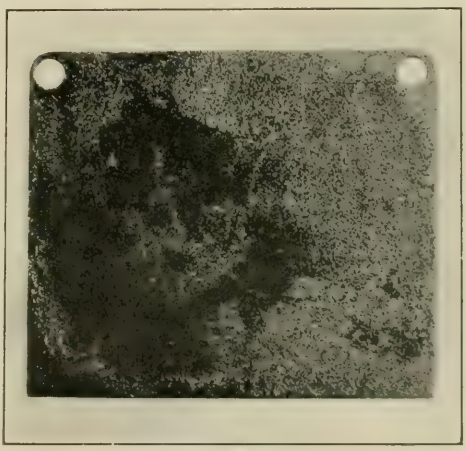
Effect of Ammonia on Nickel Plating Solutions.

It is only within the past five years that the necessity of having nickel plating solutions acid has been fully appreciated. The use of neutral solutions gives good results to be sure, but when slightly acid, the results are far better. The use of alkaline solutions, however, is attended with bad results in the shape of brittle nickel that is apt to peel or strip, frequently in the solution itself, and is of dark color.

Many of the older formulas recommended that ammonia be added to a nickel plating solution to render it alkaline, but this was found to be unsatisfactory in that the deposit thus obtained was quite unreliable and of dark color. The use of a small quantity of boracic acid or sulphuric acid to render the solution slightly acid has brought about a particularly good condition in the nickel plating trade in that it has resulted in the production of a soft, white nickel deposit that at one time would have been considered impossible.

While it is generally appreciated at the present time that a nickel plating solution should be slightly acid, it frequently becomes alkaline by the introduction of potash or soda solution upon or in the work to be plated. Slovenly work in rinsing usually brings about this condition. When potash or soda, as well as the carbonates of either of these metals are introduced into a nickel solution made up of the customary double sulphate of nickel and ammonia, a reaction takes place. Sulphates of the alkalies are formed and ammonia is set free. This may readily be noticed by adding a small quantity of a hot caustic potash or caustic soda solution to a small quantity of a nickel plating solution. Ammonia is set free which is readily distinguished by the smell.

The reason nickel plating solutions become alkaline, therefore, is not on account of adding ammonia intentionally, but from the introduction of the potash or soda cleaning solution. This is often the case when articles, such as valves, faucets or other classes of goods are plated. The solution used for cleaning them remains inside and unless carefully rinsed out, enters the nickel solution. Again, a nickel plating solution may have become too acid through the use of an insufficient number of anodes, and ammonia may have been added to bring back the necessary neutral or slightly acid condition. Too much ammonia may have been added in such a case. At any rate, the fact remains that alkaline nickel solutions are often found and are the cause of much trouble, especially when the bad effect of the ammonia is unknown.



Nickel Plated Brass Which Spontaneously Peeled While in the Solution.

Let us take a regular nickel plating solution made up of the double nickel salts, sal-ammoniac and a small quantity of boracic acid, and add ammonia to it in small quantities at a time:

At first, a slight greenish precipitate of nickel hydroxide is formed. As the solution is stirred, this dissolves. As more ammonia is added the precipitate increases and fails to dissolve. Finally, when a further addition is made, the greenish precipitate dissolves in the ammonia and a blue solution is obtained. It does not necessarily follow, therefore, that the solution should be blue and clear to have enough ammonia in it to be alkaline. Even a small quantity of ammonia will produce an

alkaline condition as the precipitate is all that is necessary to indicate it. The presence of a clear, blue solution indicates that a large excess of ammonia is present.

The effect of ammonia on a nickel solution is such that it should always be avoided. Its influence is as follows:

1. The nickel deposit has a dark color resembling iron.

2. The nickel deposit is hard and brittle and lacks the tenacity and toughness of that formed in a neutral or slightly acid solution.

3. The deposit is apt to peel. If a large excess of ammonia is present, it frequently flakes off in the solution, particularly if a high current density is employed.

In the illustration accompanying this article, is shown a plate of brass that was nickel plated in a nickel solution made of the double sulphate-sal-ammoniac and an excess of ammonia to render the solution strongly alkaline. The deposit was dark in color, resembling steel, and when it had become sufficiently thick, after about half an hour, it began to flake as shown. This took place in the solution and the nickel seemed to have a tendency to leave the base metal and curl up. The deposit was in the form of minute flakes and not in one sheet as often happens when the base metal, upon which the nickel is deposited, is not clean. In this particular instance, a current of about 3 volts tension was employed and the solution was run cold.

In conclusion, it may be said that if a nickel deposit is dark in color and peels readily, look for alkalinity in the solution. This is readily determined by the use of *red* litmus paper. If it turns blue when dipped into the nickel plating bath, then it is alkaline. To bring back the right condition, add sulphuric acid in small amounts at a time until *blue* litmus paper turns red. Great care should be taken to avoid the addition of too much sulphuric acid so as to render the solution too acid. The best method of overcoming the alkalinity of a nickel solution by the addition is as follows:

Let it be assumed that a 200 gallon nickel solution is to be treated. Take out, say 5 gallons, in a stone crock and add sulphuric acid to it in *known* amounts. Add the sulphuric acid little by little and stir after each addition. Then test with *blue* litmus paper. As soon as the paper begins to turn red, even slightly, stop. In case the solution is to be made acid with boracic acid, that is when boracic acid is used in a nickel solution, a neutral point must be reached. This is found when the solution neither turns blue litmus paper red, nor red litmus paper blue. It is a little more difficult to reach this point, but with care the solution can be made to show it.

When the desired point has been reached, note the amount of sulphuric acid that has been used. Then multiply the amount by 40 and the amount of sulphuric acid necessary to neutralize the whole 200 gallons will be found. As an example let it be assumed that ¼ oz. of sulphuric acid (fluid oz.) has been used to neutralize the 5 gallon solution. Then 40 x ¼=10, so that 10 oz. of sulphuric acid must be used in the 200 gallon solution.

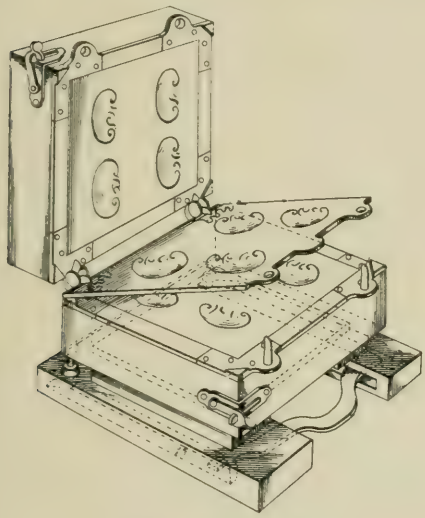
This method of procedure is far better than adding the sulphuric acid directly to the 200 gallon solution, as it eliminates the uncertainty of obtaining the right point in so large an amount.

An Improved Foundry Flask.

An improvement in foundry flasks, for use with either hand or machine molding, has been patented by William J. Keep, superintendent of the Michigan Stove Co. of Detroit, Mich. The improvement is both in the flask itself and the pattern plate. The flask and plate are herewith illustrated.

In operation, the parts are placed in close relation, with the matchplate between the cope and the drag, and by the rearwardly extending projections from the matchplate, which engage in the **V** shaped openings of the spool of the flask hinges. The cope and the drag are brought into proper register by means of the pins and the horns of the hinge which engage with the spools, the groove of the one part engaging the ridge of the other part. If the flask be a small one, it may be rammed, but it is preferably placed on a machine and squeezed. If the flask is small the drag is filled with sand, the bottom board adapted to engage inside the walls of the flask, is placed on the sand, the entire flask is turned over on the press, the cope is filled, leveled off, and the press boards placed upon it, and with a squeezer both boards are forced into the flask until the sand in both is packed to the required amount. The sand in this case is placed between each of the squeezing boards and each side of the matchplate. In a small flask, in

which the sand has been pressed by the squeezer, the frame of the drag is not supported for the reason that the bottom board is smaller than the inside of the drag, and affords no support to the frame of the drag. The weight of the frame of the cope, and of the sand in the cope, primarily rests upon the matchplate, and this in turn engages closely on the sand packed in the drag, which in its turn rests on the bottom board, and this on the bed plate of the squeezer. The frame of the drag, however, is not supported, but is held up by its adhesion to the sand packed within it. In order to remove the matchplate

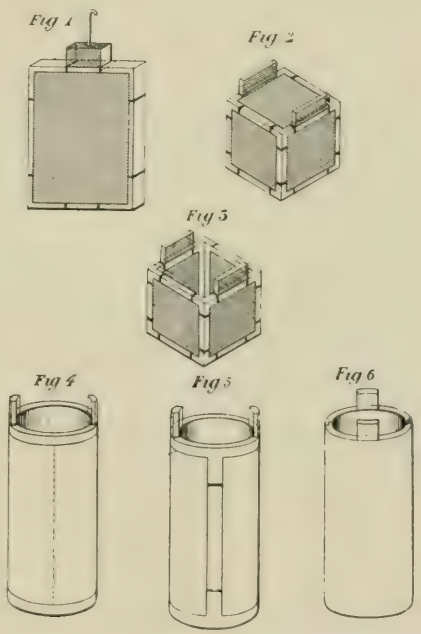


Keep's Form of Flask.

from both the large and small flasks, the cope is swung, and this brings its entire weight upon the horns of the flask hinges, which extend to the rear from the drag part of the flask, and in the small flask using the inclosed press boards there is now no support sufficient to sustain the great weight which is now brought to bear on the rear of the drag frame. There are placed under the frame part of the drag adjustable sustaining members which may be adjusted to correspond with the amount that the press board protrudes from the drag after the sand has been properly compressed within it. A simple form of such sustaining members consists of pins that project through the table on which the flask is supported (the table of the press); these pins engage through bosses that rise from surfaces of the table and are lifted by wedges on which the bottom ends of the pins rest. The wedges are pushed in by the workman and withdrawn by the workman who grasps the cross bar which connects the two wedges. If the mold produces a casting that is too thick, the four corners of the cope or of the drag are dressed down so as to allow the cope and drag to come nearer together, when the matchplate is removed and the flask is closed; or by adding a sheet of metal to all corners, the cope and drag will be forced farther apart, and when the matchplate is removed and the flask closed, a thicker casting will be produced.

A New Process for Producing Art Metal Wares by Electro-Deposition.

A new process for the production of metal ware by electrodeposition has recently been patented by Frank Iorns Gibbs of Birmingham, England (U. S. Patent, 984,760, Feb. 21 1911). The method employed is quite different from anything yet done in this line.

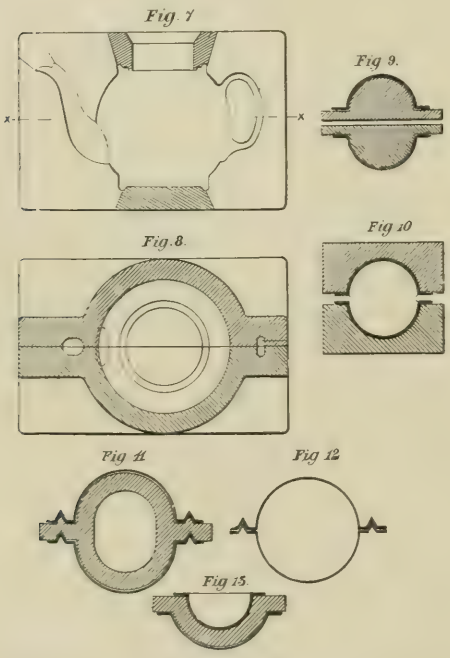


Method of Forming Sheet Metal and Tubes.

The principle of the process is as follows: An article of glass, porcelain, pottery or other vitreous material is made of the design wanted but in the reverse. In other words, it acts

as a die. The surface is coated with a metallic glaze so as to become an electric conductor. A platinum glaze is preferred although, the inventor says, any other glaze, such as that produced by gold or silver, may be employed. The metal is then deposited upon this surface to the desired thickness. While the electro-deposition takes place, the metal does not adhere, but may be stripped off. At the same time it is smooth and polished. The model may be used over and over again. The inventor describes the process as follows:

"In carrying out this invention the surface, or the parts of the surface, of the article of glass or potteryware or the brick or burnt clay slab or tile or the like on to which the metal is to be electro-deposited, is or are



Method of Forming an Article of Hollow-Ware.

coated by the potter with a glazed metallic luster, preferably a platinum luster, or it may be silver luster, or gold luster, or copper luster, or a glazed luster surface prepared with any other suitable metal in the same way that well known glazed luster potteryware is now coated or made. The copper or other metal is now electrodeposited on to the glazed luster surface of the model to the required thickness and when this required thickness has been obtained the deposit can be removed from the model and it will be found that the deposit has not adhered to the glazed luster surface and therefore the deposit can be very readily removed and the surface of the deposit which was next to the model will, by having been in contact with the glazed metallic luster surface, be beautifully polished and free from all tarnish, and practically chemically clean. Thus the expense of polishing and the polishing materials and the liquid cleaning and cleaning materials and the like are saved. This polished surface of the deposited metal article is also if desired ready for a thin coat of a noble metal or other metal or metal coloring or, being free from all dust and blemishes, can be lacquered in the ordinary way. When the glazed luster surface model from which the deposit has been removed has been carefully cleaned and swilled and free from finger marks and other impurities, it is in the same condition as when it first entered the bath for the previous deposit and is now ready for another deposit. Thus the model can be used over and over again as it and its luster surface are practically indestructible and the luster surface always remains untarnished ready for another deposit. For obtaining good results it is important that the glazed metallic luster surface has been properly and carefully put on the model by the potter so that there are no pin holes or breaks in the glazed luster surface.

Suppose, for example, a tea-pot is to be made. A mold of the vitreous material is made in the shape of that shown in Fig. 7. The metal is deposited upon it to the required thickness and then stripped, leaving the surface of the exact design and polished. It may be reinforced by soft metal on the inside or by depositing the metal to the required thickness.

The process may also be applied to the production of polished sheet metal or tubing and in this case, the molds shown in Figs. 1 to 6 are used".

The best method of recovering silver from cyanide silver solutions is to dilute with water and then add liver of sulphur. This precipitates the silver as sulphide which may be filtered out and converted into metal in any convenient way. Silver sulphide is so slightly soluble in cyanide that the metal has been found quite practical and free from the disadvantages of other methods.

The Air-Brush in Applying Japans, Paints, Varnishes and Other Similar Materials.

The use of the air-brush in applying lacquers has always been one of the satisfactory operations in the metal trades. Not only has it been a saving in the cost of applying the lacquer, but a better grade of work can be produced by it. It is rare indeed that cost can be reduced and the quality of work be increased at the same time, but the air-brush has actually succeeded in doing it.

In the plant shown in the illustration a saving of $8,000 a year was made by the use of the Eclipse air brush.

A New Electro-Plating Machine.

A new form of electroplating machine has recently been patented (U. S. Patent 986,303) by Constantine G. Miller of the Meaker Company, 218 North Elizabeth St., Chicago, Ill. The object of the machine is to provide a very large surface of the anode to the solution and

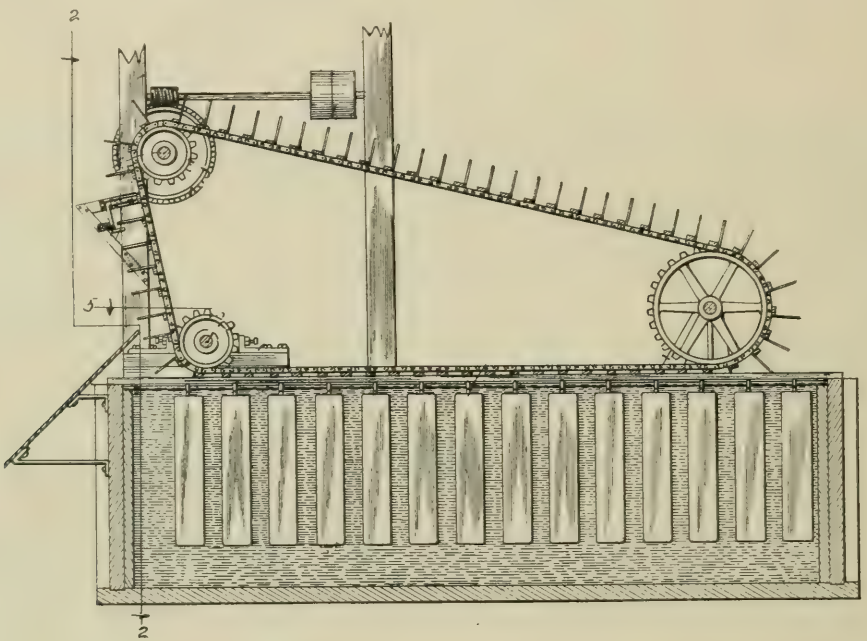
Using the "Eclipse" Air-Brush in Applying Paint, Japans or Varnishes to Metal Goods.

In the application of japans, paints, pigments, varnishes and similar coatings, the air-brush has also found a valuable use. What applies to lacquers also applies to these materials. In the illustration is shown the interior of a factory in which the air-brush is used for applying paints. The air-brushes and equipment were supplied by the Eclipse Air-Brush & Compressor Co., Nelson St., Bloomfield, N. J., to whom we are indebted for the photograph. It will indicate the manner of using the brush for this class of work.

to have means for automatically carrying the articles to be plated through the solution.

The operation is as follows: An operator stands at the receiving end of the tank, and as the chain travels downward towards the tank, engages the articles to be coated or plated upon the hooks. This is, of course, easily accomplished if the articles are apertured. If not, wire loops may be provided whereby the article may be engaged upon the hook. The chain is thus loaded progressively, and as the articles are submerged in the elec-

trolyte within the tank, the current passes through into the bus bars, thus completing the circuit. Obviously, a very large surface of the metal to be plated is exposed between the anodes supported vertically in the tank, and as the articles to be plated travel longitudinally in the tank between the same, the thickness of the coating may be regulated by the rate of travel and, of course, the current. Having passed through the tank, said articles are raised from the electrolyte upon the upward run of the chain and as the same approach the hooked jar arms these, as the successive bars engage the arm swing inwardly after which the springs retract the arms, for their hooked ends to remove the articles from the carrying hooks adapting the articles to fall upon the chute. Owing to the quick retraction caused by the spring, the arm, of the jar mechanism is thrown inwardly to engage the succeeding bar which jars the supporting mechanism and particularly the lower run of the chain gently, thus tending to constantly shift the contact surface on the hook of the article being coated. In this manner, uniformity of the coating is assured.



The "Meaker" Apparatus for Continuous and Automatic Electroplating.

Lining Steel or Iron Plating Tanks.

Although a steel or iron plating tank may be used without lining and many of them are in service without it, it is always an advantage to line or coat them.

The advantage of lining is in two things:

1. It prevents any liability of rusting, particularly above the solution.
2. It serves to insulate the tank.

Although cyanide solutions do not act upon iron or steel, there are always other materials in such plating solutions, such as chlorides or other foreign matter, which do attack the metal sooner or later. As far as the insulation goes, this also is not absolutely essential, but is very good practice and serves to prevent short circuits or stray currents from passing through the tank.

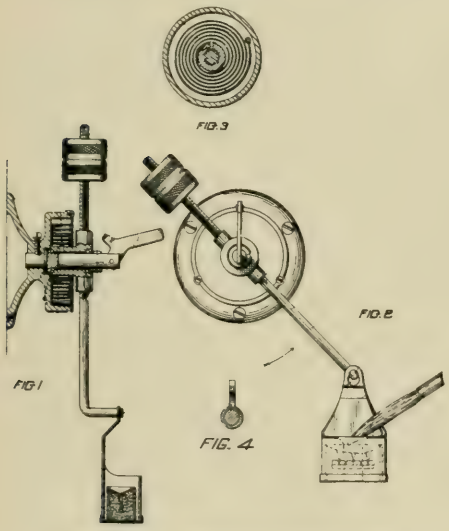
For lining, any material, such as asphalt or pitch, used in lining wood tanks may be used. The tank should be dry and the lining applied hot. It need not be very thick.

Dark nickel deposits may be caused by the presence of copper in the solution or by its alkalinity.

A Centrifugal Casting Machine For Small Castings.

A machine or apparatus for making small castings by centrifugal motion has recently been patented by F. W. Wright and Julius Pilblad of New Glasgow, Nova Scotia (U. S. Patent, 985,489, Feb. 28, 1911). While it has been designed primarily for making dental castings, it is equally applicable to other work.

The metal to be cast is melted in a cavity above the mold, as shown in the illustration. For ordinary small work, the blowpipe is used for the melting. The mold, which may be of



Small Centrifugal Casting Machine.

plaster or other suitable material, is directly under this cavity and a gate connects the two.

When the metal is melted, a trigger is released by the finger and a spring, shown in detail in the upper portion of the illustration, caused the arm upon which the mold is situated, to revolve at a rapid speed thus forcing the molten metal into all portions of the mold. When the spring re-coils to its full extent, the arm continues to revolve.

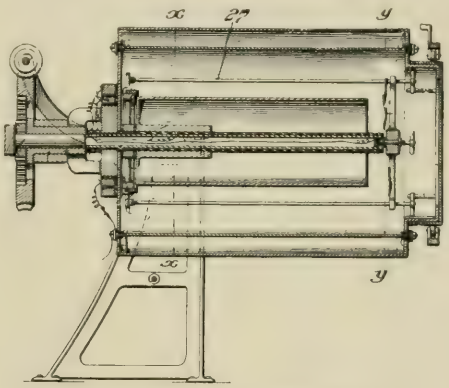
The jerk which is given the mold when the spring is released is claimed by the inventors to be particularly efficacious in forcing the metal through the gate into the mold.

The use of sal-ammoniac in a brass solution is attended with the same results as the use of ammonia. When sal-ammoniac is used, the cyanide decomposes it with the formation of ammonia.

A New Form of Electroplating Barrel.

A new form of electroplating barrel has recently been patented by John W. Heaphy of Philadelphia, Pa. (U. S. Patent 986,823, Mar. 14, 1911). The barrel is herewith illustrated in cross section.

The barrel differs from others in use in that it is sealed up like a horizontal tumbling barrel and a valve is used on it to allow the gas formed during the plating to escape. The barrel is revolved by a belt running on a pulley connected to a shaft which operates a worm wheel for performing the rotation. The



Heaphy's New Form of Plating Barrel.

worm wheel also operates another planetary gear. The first or larger gear (shown on the end of the barrel) turns the barrel itself, while the small planetary gear, turns the rack upon which the work is placed. It will be appreciated, therefore, that both the barrel and the work being plated revolve. It is stated by the inventor that this serves to remove hydrogen bubbles from the surface of the deposit.

The work is placed on a rack inserted through the end of the barrel, and is withdrawn on it. It is claimed that the work comes out very bright and clean.

As a background for etched brass name plates, a black nickel deposit has been found the most satisfactory and is extensively used. The solution does not attack the resist like alkaline solutions and the operation can be conducted cold and a large number of plates operated upon at once.

Questions and Answers.

QUESTION No. 953. What flux is used in making an aluminum bronze composed of 95% copper and 5% aluminum? I desire to cast in iron molds for rolling, but find the cast bars very dirty. It would seem, therefore, that the difficulty was on account of not using the right flux.

Answer. Use no flux in making this bronze. Melt the copper under charcoal and then add the aluminum. Stir well and pour into ingot molds (pigs). Then remelt and pour into your iron molds for rolling. It has been thoroughly established that the aluminum bronzes are always better when melted twice. The use of fluxes has not been found advantageous. The dirt you mention as being present in the cast bars is the oxide of aluminum and always forms when the metal is exposed to the air in pouring. If you use a bottom poured mold you will obtain cleaner castings. It is customary to plane off the surface of bars of this kind for rolling in order to remove the dirt and dross. There seems to be no other method of producing a clean casting that is fit for rolling.

QUESTION No. 954. Can as good results be obtained in gold plating by using a carbon anode as by employing the regular gold anode?

Answer. Yes, you can obtain equally as good results. Many gold platers prefer an insoluble anode and use a platinum one, and the carbon will answer equally as well. Unlike other metals, gold is deposited when the solution contains very little gold, so that it is unnecessary to constantly maintain the initial amount of gold in the solution. You will, of course, have to replenish your solution from time to time with gold salts.

QUESTION No. 955. What is meant by "boiling" copper? The question often comes up in making brass and many melters say that the copper should be allowed to "boil" in order to become sufficiently hot.

Answer. By the "boiling" of copper is meant its actual ebulition. It is, in reality, the bubbling of the copper caused by the expulsion of gas. Just what gas is expelled is not known, but it is assumed that the gases formed by the products of combustion are absorbed by the copper and then decomposed by it, with the liberation of the portion not finally absorbed. If the copper is kept well covered with charcoal (as it should be in melting) there will be practically no bubbling or boiling. If you can entirely prevent the boiling, the copper is much better for it as such a condition indicates gas absorption with its accompanying injury to metal. While the boiling is an indication of temperature, it cannot be called a satisfactory one to allow metal to become injured so as to know when it is sufficiently hot.

QUESTION No. 958. We have a plating barrel for plating small brass parts, such as nuts and washers and have tried both cyanide and acid copper without result. We desire to copper plate the brass. The cyanide copper stands 8 to 10 degrees Beaumé and the acid copper stands from 15 to 18 degrees Beaumé. What is the reason that we cannot deposit the copper in the plating barrel?

Answer. Use the cyanide copper for this work as you will find it more advantageous. The acid copper requires exceptionally careful work in cleaning the work to be plated, otherwise the copper will not adhere. It is not used for this class of work. The cyanide copper, on the other hand, will be almost self cleaning, and if the work is slightly stained or slightly greasy, the solution will clean it before the copper begins to deposit. You will readily understand why it is used. Your difficulty with the barrel is caused by the use of a too weak solution. Instead of having it stand 10 degrees, strengthen it until it stands 20 degrees, and if your current is strong enough, you will then have no trouble. Be sure your connections are clean.

QUESTION No. 959. In building a battery of 12 pit furnaces for melting with coke in crucibles and using natural draft, will it be better if the flues, leading into the main flue, are placed at an angle instead of entering straight?

Answer. As it is equally as easy to build the flues at an angle we advocate it for the reason that air passing through them is analagous to water passing through a pipe. The straighter the pipe and the less the number of angles, the less the friction.

QUESTION No. 960. In copper plating brass castings we have trouble in spotting out. We know that this can be overcome by allowing the plated goods to stand for some time so as to give the solution in the cavities time to work out, but this takes too long. Why cannot an acid copper solution be used instead of a cyanide copper bath and thus avoid the spotting out?

Answer. There are two difficulties in the use of an acid copper solution for your class of work, and if you overcome them, you can probably use it with good results. They are: 1. The fact that an acid copper solution has no grease removing properties. This means that the work must be scrupulously clean, and if not, the copper deposit is apt to peel off. 2. An acid copper solution does not "throw" like a cyanide copper solution. This means that the deposit will not reach deep pockets or holes in the work. Plain work, of course, or that of the average kind, can be plated without difficulty. While the use of an acid copper solution will not entirely overcome the spotting out, it will greatly lessen it.

QUESTION No. 961. What is the reason that zinc is not used to a greater extent in aluminum alloys used for making sand castings? As near as I can find out, the aluminum and copper alloys are the ones generally employed.

Answer. The disadvantage of zinc in alum-

inum alloys for sand casting is that it causes it to crack. While the cracks may not be visible in the casting, they frequently are of the "latent" type which open while the casting is in use. As the largest use of aluminum castings is in automobiles, the presence of such "latent" cracks is a serious objection. The aluminum and copper alloys are the safest and cast without difficulty. These alloys show little tendency to crack in the mold.

QUESTION No. 962. I am anxious to produce a black finish on steel similar to sample sent you. This sample was done in Germany and you will note it is a dead, opaque black that is very durable and black without the "off-color" shade frequently found on oxidized copper, silver or black nickel. How was the finish produced?

Answer. The finish on the article is nothing but a dead, black lacquer that is now so extensively used. It is an excellent and durable finish and is readily applied. It is now extensively used on automobile lamps, optical goods and similar kinds of wares. It is frequently called "optical black." You can obtain it from regular lacquer manufacturers.

QUESTION No. 963. We are having some trouble with our soft yellow brass castings used for gas or electric fixtures. We are using a mixture of 2 parts of copper and 1 part of spelter. We can get the color with this mixture, but the castings are too hard to buff up without grinding. We can get a fairly soft casting by the use of aluminum with the 2 and 1 mixture, but we then cannot obtain the color desired. We have tried various proportions, fluxes but without result. We find plenty of soft, tough castings on the market but we do not seem to be able to make them.

Answer. We fail to understand why you cannot obtain a soft casting from your 2 and 1 mixture. This is a very soft brass and is the one extensively used for yellow brass castings. The gas fixture makers all use it. Your castings should be sufficiently soft to bend double. There are two things possible: First, you may not be using good metals in making your brass. They may contain sufficient impurities to harden the brass. Second, you may be making an error in weighing your mixture. Send sample for inspection if you do not find what the difficulty is.

QUESTION No. 964. What is "Guinea-Gold", and can it be deposited?

Answer. Guinea-Gold was at one time the standard gold mixture used for gold coins in England. It consists of the following:

Gold	22 parts
Silver	1 part
Copper	1 part

It can be deposited by using a solution made up in the manner of a regular gold solution, but employing the Guinea-Gold instead of fine gold. The color is greenish-yellow.

QUESTION No. 965. What mixture can I use for castings to stand hydraulic pressure of about 20 lbs. I want something better than yellow brass as my customer is willing to pay for good metal in the castings, and there must be no leakage.

Answer. The pressure of 20 lbs. is not at all severe. In fact it is a rather low one to call a "hydraulic pressure". It is about the average water pressure. We advocate the use of a good steam-metal mixture as follows:

Copper	88 lbs.
Tin	7 lbs.
Lead	3 lbs.
Zinc	2 lbs.

This mixture will give you fine castings and stand the pressure in an excellent manner.

QUESTION No. 966. We manufacture a metal seal for bottles and are endeavoring to find a cheap metal that we can use for making it and which will not rust or corrode when it comes in contact with mustard, olive brine etc. Can you suggest anything?

Answer. The only metals that could be used are the following: Pure nickel, silver, gold and platinum. Pure nickel will stand fairly well but will corrode in time. Silver will give good results but you will find it altogether too expensive for the purpose. Gold and platinum, of course, are too costly to be employed.

QUESTION No. 967. Can the fins or burrs on small brass castings be taken off by tumbling with steel balls? We are making small castings and find it too expensive to grind off the burrs or fins in the usual maner and thought that possibly tumbling them with steel balls would do the work.

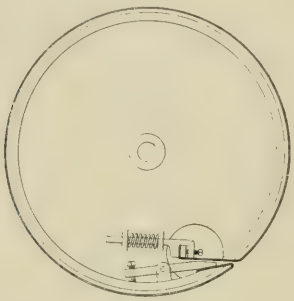
Answer. You cannot use steel balls for this purpose. The balls are used only for burnishing small metal goods. You can, however, remove the fins or burrs by tumbling if they are not too large. Tumble the castings alone and it may produce the desired result as it frequently happens that this is all that is required. In case you do not find it to do the work, tumble with sharp gravel.

QUESTION No. 970. Would it be feasible to make die castings of an alloy which contains the following: Aluminum, 71%; zinc, 28%; and copper, 2%? I have been informed that the shrinkage of the metal will not allow the casting to be made successfully. Others say that the steel die mold will be spoiled. Do you think it is possible to cast this alloy successfully?

Answer. Alloys of this kind, containing aluminum as the principal ingredient, shrink excessively and this tends to tear the casting apart in the mold while cooling is taking place. You will be able to cast some simple shapes where the casting is free to shrink without rupturing itself. Complicated shapes cannot be made successfully. The mold will be acted upon slowly and will gradually be burned out on account of the heat of the aluminum alloy, but it will last a long time. The higher the melting point of the metal, of course, the more the steel mold will be attacked. The metal that is now successfully made in steel molds contains zinc, as the principal ingredient, or tin, so as to obtain a low melting metal.

Patent Abstracts.

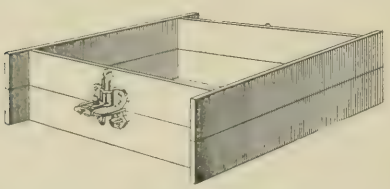
986,246, Mar. 7, 1911. GRINDING AND POLISHING WHEEL. Frank J. Tone of Niagara Falls, N. Y. Assignor to the Carborundum Company of the same place. A form of wheel for grinding or polishing upon



which a strip of abrasive cloth or paper is fastened. The feature of the device lies in the manner of fastening the end of the strip as shown in the illustration.

987,867, Mar. 28, 1911. ART OR PROCESS OF CASTING THIN STRIPS OF METAL. Bert C. Edkin, Assignor to the German Bronze Co., of Erie, Pa. A method of making brake shoes of a metal made of equal parts of copper and lead. The invention is to avoid the cracking of the metal in the mold when it shrinks. A sheet of wire gauze is cast in the metal by inserting it in the mold and this constitutes the novelty of the invention.

986,223, Mar. 7, 1911. FLASK GUIDE. Harry J. Schaumleffel of Marion, Indiana. An adjustable flask pin or guide so constructed

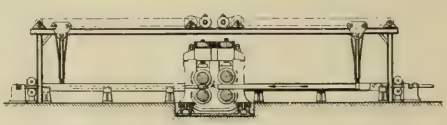


as to avoid any shifting or rocking of the cope of the flask while it is being withdrawn from the drag.

984,985, Feb. 21, 1911. MOLDERS' TOOL. James Whitehead of Philadelphia, Pa. A form of tool for packing or ramming the sand under the flask bars of a mold. In ordinary practice this is done by the fingers, and the tool herewith described is intended to obviate their use in packing the sand.

986,130, Mar. 7, 1911. CENTRIFUGAL CASTING APPARATUS. Edgar P. Binford of Chicago, Ill. A method of casting small amounts of metal centrifugally. The metal is melted in the basin over the gate of the mold and then the mold rapidly rotated by hand. The mold is fastened to a rod by a chain, and the rotation accomplished by swinging around by the hand.

984,569, Feb. 21, 1911. ROLLING MILL FOR METAL TUBES. Max Koch of Ratingen, Germany. The mill consists of two sets of rolls. The mandrel is situated between one



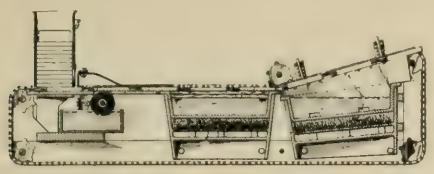
set of rolls and remains stationary. The tube is forced by the other set of rolls upon the mandrel and the reduction thus effected.

987,318, Mar. 21, 1911. MANUFACTURE OF THIN ELECTROLYTIC IRON PLATES OF LARGE AREA. Wilhelm Pfanhauser of Leipzig, Germany. The object of the invention is to deposit large sheets of iron which may be stripped from the cathode. The solution used is not given, but either the chloride or sulphate is employed. The essential feature of the process lies in carrying on the electrodeposition of the iron in a heated solution. It is used from 75 to 85 degrees C.

987,947, Mar. 28, 1911. ELECTROLYTICALLY REFINING ALLOYS. Anson G. Betts, of Troy, N. Y. A process of depositing an alloy of nickel and iron analagous to nickel steel, by the use of nickel steel anodes. The object is to maintain the proportion of iron and nickel deposited.

987,442, Mar. 21, 1911. METAL FOUNDER'S MOLD. James Francis Digan of Logansport, Ind. Assignor to the Logansport-Radiator Equipment Co. The mold is made with a partition in the middle so that two sections of a casting can be produced. The object of the partition is to prevent the gas from one part of the mold from passing to the other, as it is apt to do when the partition is not used. The partition is placed in both the cope and nowel.

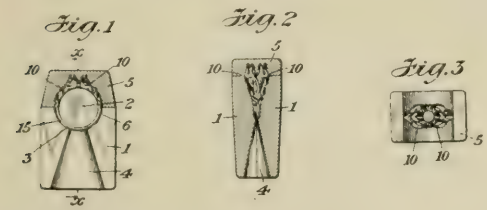
985,151, Feb. 28, 1911. TUBE SOLDERING MACHINE. John M. Fedders of Buffalo, N. Y. Assignor to Theodore C. Fedders of the same city. A method and apparatus for soldering the side seams of the square copper



or brass tubing used on automobile radiators. The tubes are fed to the flux and soldering baths automatically so that the operation is continuous. The object is to obviate hand labor in soldering the tubes.

986,519, Mar. 14, 1911. METHOD OF RENDERING POROUS METALS DENSE. Charles E. Swett of Providence, R. I. Pinholes and porous spots in sterling or fine silver in the shape of ornamental articles are stopped by applying nitrate of silver, chloride of silver or other silver compound and then reducing it to metal. Several applications may be necessary.

984,659, Feb. 21, 1911. MOLD FOR RINGS. Frank Paolo Greco, New York City. A method of casting finger rings that have chased or figured portions on them. The mold may be made of any desired material, such as



plaster, sand or clay. The mold is made by pressing the pattern into the material and is made in three parts as shown. These parts are then placed together for casting. In order to use the mold the pattern must have draught.

985,823, Mar. 7, 1911. ANCHOR FOR MOLDING CORES. Henry C. Maul of Detroit, Mich. Assignor to Burdick & Son of Albany, N. Y. A core anchor for use in making any kind of castings in which the core must be fastened down to keep from floating. The shape of the anchor is the novelty of the invention. One of the uses is in the coating of gas burners for gas stoves.

985,080, Feb. 21, 1911. APPARATUS FOR FORMING CASTINGS. Thomas G. Vernon and Reuben C. Brophy of Chicago, Ill. Assignors to the Ransom & Randolph Co., of Toledo, Ohio. A method of forming small castings, particularly for dental use. The feature of the patent lies in forcing the metal into the mold (plaster of Paris) by means of a vacuum. The bottom of the mold is atached to an exhaust pump.

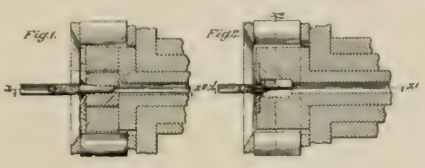
986,179, Mar. 7, 1911. ELECTRIC FURNACE. Charles Albert Keller of Paris, France. An electric furnace of the arc type with a plurality of hearths. Intended more particularly for ore and may be used for copper ore.

985,116, Feb. 21, 1911. GRINDING WHEEL. Henry B. Nichols of Philadelphia, Pa. An emery or other abrasive wheel made in separate sections and so constructed that they may be moved toward th periphery of the wheel when wear takes place. The full value of the wheel is thus obtained.

985,386, Feb. 28, 1911. PRODUCTION OF DIVIDED METALS. Fritz Blau of Berlin, Germany. Assignor to the General Electric Co., of Schenectady, N. Y. A process for producing finely divided tungsten. The oxide is reduced while at a red heat by hydrogen gas in large volume so that the steam formed by the reaction is swept away and prevented from re-oxidizing the finely divided tungsten upon cooling.

986,980, Mar. 14, 1911. SAND CORE FORMING MACHINE. Leo Michael Hennessy of Providence, R. I. A core making machine worked by hand. The sand is fed into a hopper and is mixed or stirred by an auxiliary device after which it is forced into the core box and issues from it in the form of the core of the desired shape.

987,093, Mar. 14, 1911. METHOD OF PRODUCING THIN, HARD TUBES FROM DUCTILE METAL. John E. Wilson of Los Angeles, Cal. The object of the method is to make thin gold tubing rapidly and



cheaply. A short, hard swaging plug of special shape is introduced into the tube and the reduction of the wall is then accomplished by a particular form of swaging machine.

Trade Items.

A plant, 75 x 390 feet, is to be erected by Eroe Bed Mfg. Co., at Port Houston, Texas for the manufacture of metal beds. It is stated that about 100 hands will be employed. The company was recently incorporated with a capital stock of $200,000.

The S. Obermayer Company, Cincinnati, Ohio, manufacturers of foundry supplies, have opened a branch in Boston, Mass. This branch is in charge of William Fitzpatrick, Jr, who is located at 44 Stonehurst St., Dorchester, (Boston), Mass. Eastern business will be looked after from this office.

The Wolberg-Robinson Metal Co., has been incorporated in Philadelphia, a., with a capital stock of $10,000 and will deal in white metal, such as babbitt, solder and drosses. The company is successor to S. Wolberg & Co., Front and Queen Sts., and Samuel Wolberg is president; I. Brad, treasurer; and L. C. Robinson, secretary. The company will shortly move to a new plant at 805 Washington Ave., in that city.

The American Locomotive Company of Providence, R. I., have re-opened their brass foundry which has been closed since they discontinued the manufacture of locomotives at Providence. For several years, automobiles have been manufactured at this plant, and locomotives made at the other plants of the company. Oil furnaces for melting have been installed. Brass, bronze and aluminum castings are being made.

The White Mfg. Co., of Bridgeport, Conn., manufacturers of carriage lamps, automobile and carriage hardware, have purchased the coach shade roller business of the Spring Perch Co. of this city, and will hereafter manufacture it at their establishment. The machinery and tools will be removed to the plant of the White Mfg. Co. The Spring Perch Company have carried on silver plating in the manufacture of this roller and will now discontinue it.

The firm of Shimer, McGlynn & Co., Inc. has been organized in Philadelphia, Pa., and will engage in the manufacture of special sheet metals. A rolling mill is being installed and an up-to-date equipment has been purchased for producing rolled metals as may be required for the trade. The manufacture of rolled German-silver and phosphor-bronze in sheets, rods and wire will be the principal business in sheet metals. Shot copper and gold alloys, as well as brazing solder and silver solder, will be made. The shot copper and gold alloy will be sold in tin containers of 5, 10 and 25 lbs. with screw top. A nickel alloy for resistance work is also to be produced. Herbert M. Shimer is president of the company, and Wm. P. McGlynn, formerly with the Riverside Metal Co., general manager. The rolling mill is at 19th. and Washington Ave.

The Cincinnati Bronze & Aluminum Casting Company has been organized in Cincinnati, Ohio to conduct a brass foundry and make brass, bronze and aluminum castings. Martin Burns, formerly brass foundry foreman of the Lunkenheimer Co. of that city, is one of the organizers of the new company.

The West Penn Plating & Mfg. Co., 1308 East Ohio St., Pittsburgh (N. S.) Pa., electroplaters are considering the installation of a small brass foundry for making brass and aluminum castings. They have recently commenced the manufacture of pipe hooks, straps and hangers and the brass castings will be necessary in the making of this product.

The Niagara Alkali Co., Niagara Falls, N. Y., manufacturers of high grade caustic potash by the electrolytic process, and pure muriatic acid, are rapidly completing a plant for the manufacture of Carbon Tetrachloride and will soon be in a condition to place a superior article on the market. This liquid is fire-proof and is used as a solvent for oils, greases, resins, gums etc., in place of benzine, turpentine and other inflammable solvents. A large consumption will undoubtedly be found for the product in the near future.

A. E. Flavell is the American representative of the "Coslett Process" for coslettizing iron or steel goods. This process is now being used by many of the largest concerns in England for producing a black and rust proof finish on iron and steel and a number of the large American concerns are using it. It has the advantage that it can be applied to hardened and tempered goods as it is produced by boiling. A. E. Flavell is now at the King Edward Hotel, 47th St., New York City where letters may reach him and information about the process obtained. The extensive use of the process in England is such that American manufacturers should investigate.

The Electric Smelting & Aluminum Co., Lockport, N. Y., have recently issued a new catalogue of their products. Each product is listed under a separate heading and fully described. The catalogue is compiled in a very attractive manner. Among the products of the company are: Pure Aluminum Ingot, Nickel-Aluminum, Aluminum Alloys for Casting, all percentages of Aluminum Bronze, Aluminum-Solder, Silicon-Copper, Manganese-Copper, Manganese-Alloy, Manganese-Bronze, Silver-Bronze, Phosphor-Tin, Phosphor-Copper, Babbitt-Metals of all grades, and "Mineral Cleaner" that has proved to be so very satisfactory in cleaning metals for plating without tarnishing them. Some of the products have recently been placed on the market and the babbitt-metals, phosphor-tin, phosphor-copper and aluminum-solder are some of these new materials. The catalogue will prove exceedingly instructive and will be sent to those interested.

The Southern Iron & Equipment Co., of Atlanta, Go., are now operating a jobbing brass foundry and supplying brass castings for the trade. Their works are on the Southern Belt Railway and office 211 Grant Building.

Samuel Butter & Co., 508 Atlantic Ave., Boston, Mass., scrap metal dealers, are to enter the manufacture of brass and composition ingot metal. They will make it at the foundry formerly conducted by the Machine Molded Brass Casting Co., 285 South St., Boston, Mass.

Anyone who is a user of plating, polishing and buffing supplies, should first correspond with D. B. Moyer of Walled Lake, Mich., and obtain prices from him. Mr. Moyer recently established himself in business as manufacturers' agent and represents the Harshaw, Fuller & Goodwin Co. of Cleveland, Ohio, manufacturers of nickel anodes, nickel salts and plating chemicals; Divine Bros. Co. of Utica, N. Y., buff manufacturers; and the Auburn Soap & Chemical Co., of Auburn, N. Y., manufacturers of plating and polishing supplies. Mr. Moyer handles only the highest grade of supplies and welcomes inquiries on the subject. He desires the opportunity to quote.

The tumbling barrel that the Abbott Ball Co., 12 Hix St. Hartford, Conn., manufactures for use in burnishing small metal goods by means of steel balls, has been designed by Mr. Abbott with reference only to such an operation. As he was the first in the United States to manufacture steel balls particularly for burnishing work by tumbling, it will be appreciated that the barrel is the result of long experience. Anyone who manufactures small metal goods should investigate steel ball burnishing, and the Abbott Ball Co. solicit inquiries. They desire to send information to all who desire it, both on the barrel and the method of tumbling with steel balls. An interesting and valuable booklet is published by them on the matter and will be mailed to those who ask for it.

Attention is called to the new flux "Radioclarite" manufactured by the Basic Mineral Co., of Pittsburgh (North Side), Pa. This is the flux which the makers say: "Has made good." It is suitable for use in melting all kinds of brasses, bronzes and non-ferrous metals. What the makers claim is as follows: 1. It will clean the dirtiest sweepings and eliminate *all* iron. 2. No separator need be used in melting turnings. 3. It increases the life of the crucible. 4. It increases the rapidity of melting. 5. It reduces the waste in melting. 6. It greatly improves tin bronzes and renders them sounder. Steam metal is particularly benefitted. 7. The metal is more fluid when melted and blowholes are eliminated. Free trial sample to applicants in good faith. The merits of the flux are more fully described in a circular and booklet issued by the company and which will be sent to those interested.

Charles E. Lawson has taken over the brass foundry conducted by Yahnig & Cohoon of Bristol, Conn. The foundry is located at 77 North St., and a jobbing business is carried on.

A smelter with a capacity of 2 tons has been installed by the Newark Assay & Sampling Works at 350 Mulberry St., Newark, N. J. James H. Reid is the inventor of the electric furnace that will be used and was formerly connected with the Westinghouse Company. Gold and silver materials, ores, etc., will be treated in the furnace.

R. F. Lang, 31 Broadway, New York, the well known importer of phosphor-copper, silicon-copper, manganese-copper etc., will shortly go on his annual trip abroad in order to confer with manufacturers there. He expects to increase his sales in phosphor-bronze and pure nickel rods for wire drawing for which additional equipment may be needed. The sales of Royal manganese-copper are increasing. This is a German product where it is very extensively used. It is possible by its use to make manganese-bronze very readily. Mr. Lang reports that the Krupp Works at Essen and the Imperial Navy Yards at Kiel use large quantities of manganese-copper in the manufacture of bronze and brass castings.

The Celluloid Zapon Company, Metropolitan Building, New York City and works at Stamford, Conn., have just issued two new booklets on lacquers which should be in the hands of all lacquer users and will be sent upon request. One is entitled "Colored Celluloid Enamels" and is a color chart of the various grades of tinted lacquers made by this company. Two charts are given, one on body colors and another on tinting colors. Directions for using the colored lacquers are given. The other booklet is upon "Celluloid Zapon Enamels" and a full description of the method of applying these enamels is given. These booklets will prove of much interest to those who read them as they contain information not heretofore published. They have been compiled for distribution to the trade.

Among the new products that have recently made their appearance on the market is "Bakelite" a substance made from carbolic acid and formaldehyde and the invention of Dr. Leo Bakelund of Velox Paper fame. This material has been one of the interesting products of recent years. Its uses are many. It is used to replace hard rubber for ornamental and electrical purposes. It is now being placed on the market in soluble form for use as a lacquer. The durability and heat resisting properties of the properties of this lacquer, when applied to metal surfaces, are such that it seems to fill a new field. It is believed that such a coating offers all the advantages of hard rubber, Japanese lacquer and celluloid. The General Bakelite Company, 100 William St., New York City has been formed for the purpose of marketing the Bakelite products and full information will be given on request as well as circulars sent.

A new core room has been completed by the Georgian Mfg. Co., of Binghampton, N. Y., manufacturers of plumbers' brass goods.

Davenport & Keeler, 214 Main St., New Britain, Conn., industrial and sanitary chemists, have an attractive and special proposition to offer in regard to the analyses of metals and alloys. See their advertisement elsewhere.

The Bristol Company of Waterbury, Conn., manufacturers of the Bristol Recording Instruments, are sending out to the trade their new Bulletin No. 131, which is a 44 page catalogue of the Bristol Recording Voltmeters for switchboard and portable use. A partial list of 1000 users of the Bristol instruments is given in the Bulletin.

The Metal Dross Economy Co., of Bristol Conn., manufacturers of skimming tanks for recovering metal from brass and bronze skimmings, report a constantly increasing business. Tanks have been installed in many of the largest plants in the United States and wherever used a great saving in metal has been effected. After a few trials, users of the skimming tanks become enthusiastic and report that metal previously wasted can be easily saved.

The Niagara Alkali Co., Niagara Falls, N. Y., manufacturers of electrolytic caustic potash and pure muriatic acid, announce that their muriatic acid shows by analysis to be of exceptional purity. The results are as follows: Acidity as HCl, 34.69%; Non-volatile matter, 0.0974%; Iron, 0.0079%; Aluminum, 0.0060%; Sulphuric Acid, 0.0050%; Free Chlorine, 0.0115%, Lead, none; Arsenic, none. This analysis was made upon 22° Beaumé acid, and the 18° product shows even less amounts of impurities.

The Bayonne Casting Co., Bayonne, N. J., which makes a specialty of making castings of Monel-Metal and have a large foundry particularly built for casting it, have just issued a new catalogue on "Monel-Metal" which is full of interesting information and facts concerning this interesting alloy. It really contains all the information that is necessary in regard to the properties of the metal and has been issued to satisfy a demand for accurate and scientific information. The office and works of the company are on East 10th. St., Bayonne, N. J., and the catalogue will be sent to those who desire it.

The annual meeting of the American Brass Founders' Association as well as the American Foundrymens' Association, Associated Foundry Foreman, and the Foundry & Machine Exhibition Co., will be held in Pittsburgh, Pa., May 23-24-25-26-27. Preliminary circulars have already been issued and may be obtained from W. M. Corse, Secretary, care of The Lumen Bearing Co., Buffalo, N. L. These circulars also contain a map of Pittsburgh which will assist visitors. The Exhibition will be held at the Exposition Buildings and in addition to the large exhibit, many interesting papers are promised. A large attendance is expected.

The Southern Brass & Foundry Co., 607 State St., Knoxville, Tenn., are to rebuild their warehouse with an expenditure of $3,000.

W. J. Seeley, Texmo, Rogers Mills County, Oklahoma, is contemplating starting a brass foundry and wishes information in regard to equipment.

Francis A. Weisbecker & Sons, 22 Frost St., Brooklyn, N. Y., manufacture polishing machines for polishing and buffing sheet metal goods of all kinds. Brass, copper, German-silver, tin, zinc, silver and aluminum, as well as plated goods may be buffed by it. It is automatic in action and metal may be surfaced or buffed as desired. Information will be given on request.

The Flexible Emery Wheel, made by the American Oil & Supply Co., should be tried by all who do polishing. It is an entirely new product and has the flexibility of a soft rag wheel with the cutting qualities of a hard emery wheel. For polishing or grinding irregular surfaces it is excellent. It is very useful in polishing silver goods and leaves them ready for buffing. Particulars will be sent upon application. The American Oil & Supply Co., 52 Lafayette St., Newark, N. J., are the manufacturers.

The Keystone Bronze Co., 38th and 39th Sts., Pittsburgh, Pa., announce that they have taken over the plants of the Brighton Brass and Bronze Co., of New Brighton, Pa., and the bronze and copper departments of the Best Mfg. Co., of Pittsburgh, Pa. The manufacture of copper blast furnace equipment, such as tuyeres, bosh plates etc., as well as a large line of valves, bearings and similar bronze and brass castings, will be carried on as in the past. The change is one of expansion. The present plant of the company will continue in operation as before.

The Bishop & Babcock Co., of Cleveland, Ohio, manufacturers of soda fountains, beer pumps, carbonated water apparatus etc., have purchased and absorbed the Becker Company of Chicago, Ill., manufacturers of a similar line of goods. The name has been changed to the Bishop-Babcock-Becker Company and the capital stock has been increased from $1,500,000 to $5,000,000. A new plant is being built at Dallas, Texas and the Indianapolis plant has been enlarged. K. D. Bishop is president of the new company and L. A. Becker, vice-president.

The International Molding Machine Co., has been organized to take over the E. A. Pridmore Co., of Chicago, Ill., manufacturers of molding machines. The machines manufactured by this company will hereafter be known as the "International" machines. The office of the company, as well as the shops, are located at 2300 South Western Ave. J. P. Dopp, formerly with the Tabor Mfg. Co. has accepted the position as general sales manager of the company. For a number of years, Mr. Dopp had charge of the molding machine department of the International Steam Pump Co., at Cambridge, Mass.

The Marine Specialty Co., Inc., has been incorporated in Norwich, Conn., with a capital stock of $4,000 to manufacture marine indicators and similar instruments.

An establishment for the manufacture of jewelry has been started by Max D. Paul and Joseph Green at 827 South Baltimore St., Baltimore, Md. Electroplating will be carried on.

The New England Pin Co. of Winsted, Conn., manufacturers of pins and similar goods, have recently installed an electroplating plant.

A new tube mill for making seamless brass and copper tubing is to be built by the Rome Brass & Copper Co., at Rome, N. Y. The mill will be 115 x 450 feet.

C. W. Moore has severed his connection with the Housatonic Metal Co., of Stratford, Conn., with whom he has been connected since its starting.

The plant of the Cohannet Silver Co., of Taunton, Mass., manufacturers of silver plated hollow-ware, was destroyed by fire on Mar. 22 with a loss of $20,000, fully covered by insurance. It is stated that the blaze started in the lacquer room.

The Buffalo Foundry & Machine Co., of Buffalo, N. Y., recently cast a large bronze casting in the shape of a drum. This drum was 12 feet long and 5 feet in diameter and required about 16,000 lbs. of metal to pour it. The bronze was melted in a cupola.

TheCharlotte Brass Works has been established at Charlotte, N. C., by J. B. Bradford of that city. The plant is located at 508 West 4th St., in that city and plumbers' and machinists' supplies are made as well as brass castings. Mr. Bradford recently purchased the equipment of the Fielding Brass Co., of that city.

The Dawson Hardened Copper Co., has been organized at 123 Liberty St., New York City and are placing on the market a hardened copper which it is said is hard enough to take an edge. They state that the metal contains 80% of copper with tin and other elements as the remainder. The tensile strength is stated to be 37,500 lbs. per sq. in.

The Abbott Ball Co., of Hartford, Conn., manufacturers of steel balls for burnishing small metal goods by tumbling, and also tumbling barrels for use with same, have appointed Frederich Wegener, Langestrasse 24, Berlin, O 17, Germany, as agent for the sale of their goods in Germany and Austria. He will look after their interests in these countries.

The plants of the Peck, Stowe & Wilcox Company are to be consolidated with the main plant at Southington, Conn. The branch plants are now located at Plantsville, Conn., and East Berlin, Conn. The company recently increased its capital stock to $1,500,000 and the business will be reorganized on a larger scale. Hardware of all kinds is manufactured and a brass foundry conducted. Electroplating is also carried on.

The Ohio Valley Brass & Iron Co., has been incorporated in Wellsburg, W. Va., with a capital stock of $75,000 to manufacture brass and iron goods.

Richard Beddall, Copelands Corner, Revere, Mass., desires information in regard to supplies and equipment for fitting up a brass and iron foundry.

The Dalton Adding Machine Co., have now completed their new factory at Poplar Bluff, Mo., and are now occupying it. Calculating machines are manufactured. The factory is 45 x 250 feet, and cost $200,000.

The Rockwell Furnace Co., 26 Courtlandt St., New York City are sending out to the trade their Bulletin No. 28 describing their "Simplex Melting Furnace." No crucibles are used and all kinds of metals can be melted in it.

The Western Hinge & Mfg. Co., Brookfield, Mo., has been organized to take over the Twentieth Century Hinge Co., and has been capitalized at $25,000. A new factory is to be erected before the end of the year and a full line of builders' hardware will be made.

W. R. Hughes, salesman with Frederic B. Stevens of Detroit, Mich., and who covers the middle West, announces that he has installed plating and polishing plants in the following establishments: Gem City Plating Co., Dayton, Ohio; Samuel C. Tatum Co., Cincinnati, Ohio; Miller Rubber Co., Akron, Ohio; Troy Sunshade Co., of Troy, Ohio; and the Searchlight Gas Co. of Warren, Ohio.

Personal.

Charles J. Caley has served his connection as works manager of the Peterboro Lock Mfg. Co., of Peterboro, Ont., Canada and is temporarily located at 116 Newhall St., New Haven, Conn.

W. R. Dean has severed his connection as foreman of the brass foundry of the Peck Bros. Co., of New Haven, Conn., manufacturers of plumbers' brass goods, and is now located in Bath, Maine.

In our March issue, note was made of the fact that W. R. Hughes was looking after the interests of Frederic B. Stevens, manfacturer of foundry and plating supplies, in Detroit and vicinity. The item should have stated that Mr. Hughes is looking after the trade in Ohio, parts of Indiana, Pennsylvania, Kentucky and Michigan.

John H. Baird, for 25 years with the Joseph Dixon Crucible Co., of Jersey City, N. J., is now connected wih the New York and New Jersey Graphite Products Co., in the capacity of treasurer and general manager. This company is located at 253 Broadway, New York City and will handle crucibles, foundry facings, graphite paint and other graphite products.

Current Metal and Supply Prices.

These Prices are net and are for moderate quantities. Smaller quantities command higher prices. Prices subject to fluctuation.

Acetone, pure, 98-99%	lb.	.22
Acid, Acetic, pure, 30%	lb.	.07
Acid, Arsenious (White Arsenic)	lb.	.20
Acid, Benzoic	lb.	.55
Acid, Boracic (Boric), pure	lb.	.12
Acid, Hydrochloric, see Acid, Muriatic.		
Acid, Hydrofluoric, 30%	lb.	.04
Acid, Hydrofluoric, 50%	lb.	.10
Acid, Muriatic, 20°	lb.	.02
Acid, Muriatic, c. p., 20°	lb.	.07
Acid, Nitric, 38°	lb.	.05⅝
Acid, Nitric, 40°	lb.	.05⅞
Acid, Nitric, 42°	lb.	.06¼
Acid, Nitric, c. p.,	lb.	.08
Acid, Sulphuric, 66°	lb.	.01¾
Acid, Sulphuric, c. p.	lb.	.06
Alcohol, Wood	gal.	.50
Alcohol, Denatured	gal.	.55
Alum	lb.	.04
Ammonium Sulphate	lb.	.07
Aluminum, Metallic, in Ingots	lb.	.21½
Aqua-Fortis, see Acid, Nitric.		
Ammonia Water (Aqua-Ammonia), 20°	lb.	.04¾
Ammonia Water (Aqua-Ammonia), 26°	lb.	.06¼
Ammonia Water, c. p.	lb.	.08
Ammonium Carbonate, lump	lb.	.15
Ammonium Chloride (Sal-Ammoniac)	lb.	.12
Ammonium Hydrosulphuret	lb.	.30
Ammonium Sulphate	lb.	.07
Ammonium Suphocyanate	lb.	.50
Amyl Acetate	gal.	1.85
Antimony	lb.	.09½
Arsenic, Metallic	lb.	.15
Arsenic, White (Acid Arsenious)	lb.	.20
Argols, White (Cream of Tartar)	lb.	.31
Asphaltum, Commercial	lb.	.05
Asphaltum, Egyptian (Bitumen)	lb.	.30
Benzine	gal.	.15
Benzol, Pure	gal.	.75
Bismuth, Metallic	lb.	2.00
Bitumen, see Asphaltum.		
Blue-Vitriol, see Copper Sulphate.		
Borax, Crystals or Powdered	lb.	.10
Borax Glass	lb.	.35
Cadmium, Metallic	lb.	.75
Carbon Bisulphide	lb.	.10
Calcium Carbonate (Precipitated Chalk)	lb	.10
Chrome-Green	lb.	.50
Copper, Lake, (carload)	lb.	.12½
Copper, Lake, (cask)	lb.	.12¾
Copper, Electrolytic, (carload)	lb.	.12¼
Copper, Electrolytic, (cask)	lb.	.12½
Copper, Casting, (carload)	lb.	.12⅛
Copper, Casting, (cask)	lb.	.12⅜
Copper Acetate (Verdigris)	lb.	.35
Copper Carbonate, dry	lb.	.25
Copper Sulphate (Blue-Stone)	lb.	.09
Copperas, see Iron Sulphate.		
Corrosive Sublimate, see Mercury Bichloride.		
Cream-Tartar, see Potassium Bitartarate.		
Cryolite	lb.	.12
Cyanide, see Potassium Cyanide.		
Dextrin	lb.	.15
Emery Flour	lb.	.04
Emery, F F & F F F	lb.	.03
Flint, powdered	lb.	.01
Fluor-Spar	lb.	.01¼
Fusel-Oil	gal.	1.75
Gold Chloride	dwt.	.60
Gum Copal	lb.	.30
Gum Guiacum	lb.	.26
Gum Mastic	lb.	.70
Gum Sandarac	lb.	.35
Gum Shellac, brown	lb.	.50
Gum Shellac, white	lb.	.60
Iron Perchloride	lb.	.25
Iron Sulphate (Copperas)	lb.	.05
Lead Acetate (Sugar of Lead)	lb.	.15
Lead, Pig	lb.	.04½
Lead, Red	lb.	.12
Lead, Yellow Oxide (Litharge)	lb.	.12
Liver of Sulphur, see Potassium Sulphide.		
Manganese, Ferro, 80%	lb.	.10
Manganese, Metallic, pure	lb.	.75
Magnesium, Metallic	lb.	1.50
Mercury Bichloride (Corrosive Sublimate)	lb.	.93
Mercury, Metallic (Quicksilver)	lb.	.52
Mercury Nitrate	lb.	1.50
Mercury Oxide, yellow	lb.	1.80
Nickel and Ammonium Sulphate (Double Salts)	lb.	.16
Nickel Carbonate, dry	lb.	.60
Nickel Chloride	lb.	.50
Nickel Metallic	lb.	.45
Nickel Sulphate (Single Salts)	lb.	.25
Nitre (Saltpetre), see Potassium Nitrate.		
Oil of Vitriol, see Acid, Sulphuric.		
Paraffine	lb.	.15
Phosphorus, yellow	lb.	.40
Phosphorus, red	lb.	1.10
Pitch	lb.	.05
Plaster of Paris, Dental	bbl.	4.00
Platinum Chloride	oz.	25.00
Platinum Metallic	oz.	43.50
Potash-by-Alcohol, in sticks	lb.	.50
Potash, Caustic (Potassium Hydrate)	lb.	.08
Potassium Bichromate	lb.	.14
Potassium Bitartarate (Cream of Tartar)	lb.	.31
Potassium Carbonate (Pearlash)	lb.	.10
Potassium Chlorate	lb.	.15
Potassium Cyanide	lb.	.25
Potassium Iodide	lb.	2.25
Potassium Nitrate (Nitre or Saltpetre)	lb.	.10
Potassium Permanganate	lb.	.17
Potassium, Red Prussiate	lb.	.60
Potassium, Yellow Prussiate	lb.	.24
Potassium Sulphide (Liver of Sulphur)	lb.	.15
Potassium Sulphuret, see Potassium Sulphide.		
Potassium Sulphocyanate	lb.	.70
Pumice, Ground	lb.	.05
Quartz, Powdered	lb.	.01
Rosin, Yellow	lb.	.04
Sal-Ammoniac, see Ammonium Chloride.		
Sal-Soda, see Sodium Carbonate.		
Silver Chloride, dry	oz.	.75
Silver Cyanide	oz.	1.00
Silver, Fine	oz.	.53
Silver Nitrate, crystals	oz.	.50
Soda-Ash	lb.	.05
Sodium Biborate, see Borax.		
Sodium Bisulphite	lb.	.15
Sodium Carbonate (Sal-Soda), crystals	lb.	.02
Sodium Hydrate (Caustic Soda)	lb.	.05
Sodium Hydrate (Caustic Soda) by Alcohol (in sticks)	lb.	.45
Sodium Hyposulphite ("Hypo")	lb.	.04
Sodium Metallic	lb.	.90
Sodium Nitrate	lb.	.05
Sodium Phosphate	lb.	.09
Sodium Silicate (Water-Glass)	lb.	.04
Soot, Calcined	lb.	.15
Spelter, see Zinc.		
Sugar of Lead, see Lead Acetate.		
Sulphur (Brimstone) in lump	lb.	.05
Tin Chloride	lb.	.43
Tin, Metallic	lb.	.42
Turpentine, Venice	lb.	.35
Verdigris, see Copper Acetate.		
Water, Distilled	gal.	.15
Water-Glass, see Sodium Silicate.		
Wax, Beeswax, yellow	lb.	.45
Wax, Carnauba	lb.	.70
Whiting (Ground Chalk)	lb.	.02
Zinc Carbonate, dry	lb.	.19
Zinc Chloride	lb.	.12
Zinc, Sulphate	lb.	.06
Zinc, (spelter)	lb.	.05½

THE BRASS WORLD AND PLATERS' GUIDE

VOL. VII. BRIDGEPORT, CONN., MAY, 1911. No. 5.

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Failure of Aluminum Castings Containing Zinc.

It is a more or less general belief that the presence of zinc in aluminum sand castings causes them to crystallize in service, and for this reason the aluminum-zinc alloys have been avoided to a certain extent in automobile service. Such service is, without doubt, as severe, as far as the crystallization of metals is concerned, as any that could be found.

While the belief that aluminum-zinc crystallizes in service is quite prevalent, it seems to lack substantial proof and some authorities claim that it does not crystallize. They cite instances in which castings of aluminum-zinc alloys have been in service for a long time without indication of any crystallization, while others maintain that castings have quickly crystallized and broken in a short period.

We are inclined to believe that the aluminum-zinc alloys do not actually crystallize while in service, although they may break. To lay the blame of a cracked casting upon crystallization is so simple that it is frequently done when a defective piece of metal is encountered. Some reason has to be assigned for it, and when crystallization is assumed to be the cause, everybody is apparently satisfied as it does not result in placing the blame on either the maker or the user, but upon nature itself.

We feel quite sure that the so-called crystallization of the aluminum-zinc castings is,in reality, a cracking of the casting. Not a cracking or fracture that takes place while the casting is in service, but the opening up

of latent cracks that were found while the casting was cooling in the mold. In other words, the shrinkage of the casting in cooling results in the formation of fractures which cannot be seen with the naked eye, but when pressure is put upon it either in machining or in service, they open so as to become apparent to the eye. A good name for them is "latent fire cracks" as they exist in the casting from the start. The aluminum-zinc alloys seem to be more or less hot short and this causes fracture in shrinking.

While the aluminum-zinc alloys are strong, they are difficult to cast in some shapes and are quite apt to crack in the mold with the formation of the "latent" cracks previously mentioned. For this reason the aluminum-copper alloys are to be preferred for the majority of work on account of their freedom from hot-shortness and the accompanying absence of danger of cracking in the mold.

Iron in Nickel Solutions.

The presence of iron in nickel plating solutions is very common indeed for the reason that all commercial nickel anodes contain it to a greater or less extent. The iron gradually accumulates in the solution. The iron then deposits along with the nickel to a certain extent. With a weak current, very little is deposited, but as the current is increased, more iron deposits.

At one time the presence of iron in the nickel deposit was looked upon as a very serious matter, but lately it not only has been looked upon less gravely, but in many instances is actually considered beneficial, particularly for certain kinds of work.

Iron hardens the nickel when it is present in the deposit, and also produces a whiter color. To be sure nickel containing a small quantity of iron tarnishes more readily, but even so it does not rust, but is subject only to the tarnish which is not a serious matter on many classes of work.

When iron is present in the nickel deposit so that it is hardened appreciably, it is possible to buff it to a much higher "color" than when a pure, soft nickel has been plated on the work Hard metals always take a higher polish than soft ones, and so the nickel and iron alloy takes a very high "color". This "color" is very pleasing on some classes of goods, and concerns running a nickel solution with considerable iron in it and thus obtaining a nickel and iron alloy as a deposit turn out some particularly fine examples of work. The deposit is quite white and so hard that it can be buffed to a "color" that is found only in the finest steel. Hard buffing compositions are quite necessary, of course, in "coloring" the deposit.

Spots on Lacquered Sheet Metal Goods.

Small spots are frequently found on sheet metal goods that have been plated and lacquered. They are more frequently found on sheet steel goods that have been copper or brass plated and then lacquered. Sometimes they are few in number, and then the whole surface is covered and the spots seem to grow as time elapses.

These spots are not caused by cavities or blowholes in the metal, as they are on castings that have been plated, as sheet metals have been rolled and are quite free from imperfections. *The spots are caused by blisters on the plated surface.*

When sheet steel or other sheet metals are plated with brass or copper, blisters are very apt to form, particularly if the surface of the metal is slightly greasy (as it frequently is on sheet steel on account of the difficulty of cleaning the mineral oil or grease on the surface). These blisters may be quite minute so as to be almost invisible, but underneath each is some of the plating solution. This gradually oozes out and first corrodes the surface of the metal deposit, and, then, on account of its strong, alkaline nature, attacks the lacquer. In many instances it is believed that the lacquer is at fault, but this is not so and when a case of this kind is met, always look for the blisters.

To remedy the spotting-out by the blisters, they must be eliminated and careful cleaning of the work to be plated, low current density and as little free cyanide as possible should be considered in order to overcome it.

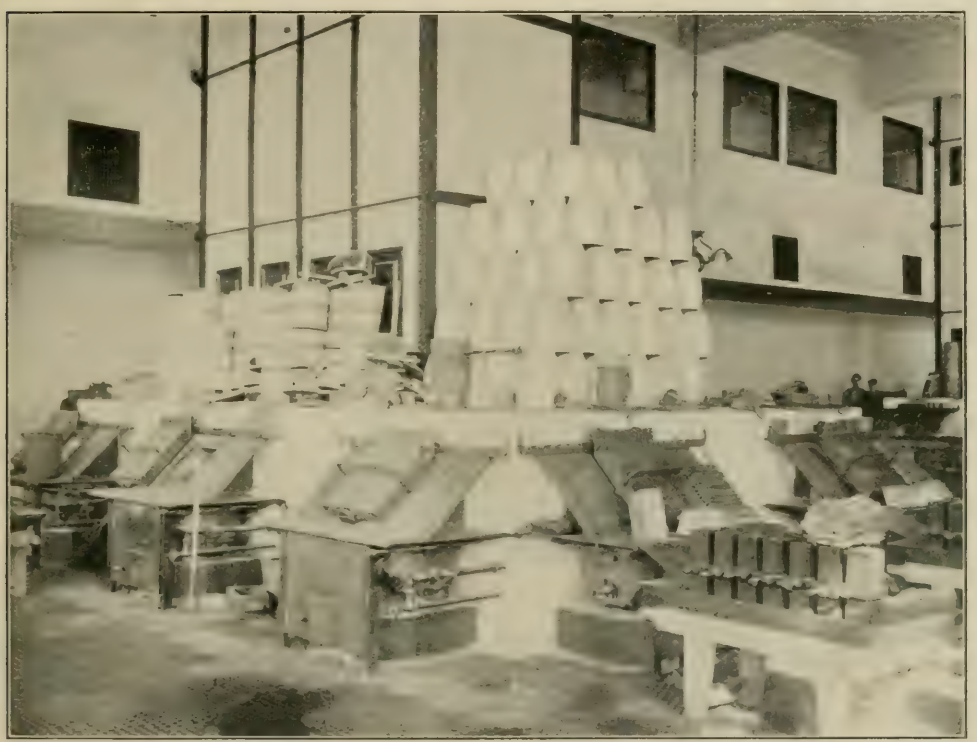
Commercial nickel anodes contain, in addition to nickel, iron, tin and carbon. These are introduced intentionally to render the anode "soft," i. e. so that it will dissolve easily in the solution during plating.

The Melting and Casting of Gold and Gold Alloys for Rolling into Sheet.

The melting and casting of gold would naturally seem a simple and satisfactory operation when its physical properties are taken into consideration. It melts readily, and without any oxidation whatever. When poured in the molten condition it runs very freely and casts soundly, with little shrinkage.

As far as fine gold is concerned, let it be understood that it must be pure in order to be used either in the fine state or as alloyed metal. Impurities affect either in the rolling order to obtain good, soft metal, that will roll without cracking. This feature will subsequently be explained.

The majority of the fine gold used in the



Melting Room of United States Mint at Philadelphia, Pa. Showing Manner of Melting the Precious Metals. Gas is Used for the Fuel.

There is no real difficulty in the melting and casting of *fine* gold and ordinary melting knowledge only is required; but it is often found that even when a sound bar of gold has been obtained in the casting, it will crack in rolling. Re-melting and casting again will not overcome this difficulty and it will again be found that the gold will crack in the second rolling. The trouble is caused by the impurities in the gold, and not in the melting and casting. This is true only in the case of *fine* gold, however, as alloyed gold requires very careful treatment in melting and casting in

United States comes from the United States Mint in Philadelphia, where it is refined electrolytically by the Wohlwill process. This process is now used with excellent success and by means of it gold almost chemically pure is obtained. A hydrochloric acid solution is used and the impure gold employed as the anode. A pure, spongy gold deposits and is then washed thoroughly, melted and poured into bars. This gold never gives any difficulty and should be used whenever possible. Gold that is frequently bothersome is that produced by small concerns in the refining of various

kinds of sweeps, filings, polishings and similar refuse. Gold obtained from other sources is also frequently troublesome. Each of these kinds is apt to contain impurities which render the gold brittle in rolling, and in order to roll it, it must be refined.

Refining the Gold.

Gold and silver are usually obtained together in the treatment of materials containing them, and then are parted by means of nitric or sulphuric acids, or an electrolytic process. The gold is left practically free from silver but containing small amounts of impurities such as tellurium, antimony, tin, lead, bismuth or selenium. If the gold were simply melted and cast, and then rolled, it would crack and it must be refined before anything can be done with it. The only method of refining it and removing the impurities which it contains is by means of either nitrate of potassium (nitre or saltpeter) or nitrate of sodium (Chili saltpeter). No other satisfactory method is known.

To refine the gold, it is melted in a graphite crucible and covered with bone-ash. A hole in the midle of the bone-ash is made by pushing it away by an iron rod. This exposes the gold. Then add small portions of the nitrate of sodium and stir frequently. The additions are continued until the surface remains clear. The presence of a film shows that gold still contains impurities. When the bone-ash has absorbed the impurities and become pasty, it is skimmed off and a fresh quantity put on. With very impure gold, the refining may take several days, but ordinary metal does not require as long treatment.

The theory of the action of the nitrate of sodium is that it gives off oxygen when melted which oxidizes the impurities in the gold and causes them to enter the slag on the surface. When the surface of the gold remains clear after the slag has been removed, it indicates that the gold is practically free from impurities.

The gold is then poured into bars and rolled if desired, but if it cracks in rolling, it indicates that the impurities have not been completely removed and it will have to be melted again and treated with the nitrate once more. This treatment for the purpose of removing the impurities is called "nitreing". The treatment will have to be repeated until all of the impurities have been removed, and there is no other way out of it.

Silver, however, cannot be removed by the nitrate treatment and must be completely removed by previous parting. It will not affect the rolling quality of the gold, though, but will change the color. Gold with a greenish yellow shade contains silver. To obtain the color of fine gold, there must be no silver present.

There is not much fine gold used in the arts with the exception of two classes of work: First, electroplating. Second, dentistry. Gold for jewelry is practically all alloyed. For dental work, gold refined by the Wohlwill process is very extensively used as it is so soft that it gives excellent results. For electroplating as pure a gold as possible is desirable in order to obtain the necessary color.

The production of the alloyed or karat golds requires greater care and skill in melting and casting them in treating fine gold. It is the copper that is used in the alloy that makes the trouble and this is caused by the oxygen absorption. Silver is also used in the alloying but gives no trouble. Were it possible to use the silver alloy for the alloy, there would be little difficulty in the casting, but this is rarely done on account of the poor color obtained. Copper is necessary to produce the right shade.

In melting the karat gold, the following method is used:

A graphite crucible is always used for the melting. Clay crucibles can be used, but as they are apt to crack with a loss of gold, the graphite ones are preferable. The required amounts of copper and silver are placed in the bottom of the crucible and the gold put on it. A covering of moderately fine charcoal is then put on in order to prevent the ingress of oxygen and supply a reducing atmosphere. As charcoal is apt to blow off, when a gas blast furnace is used, a better material for use is sugar. This is a very pure form of carbonaceous material and when it is decomposed by the heat, a sort of flat cake of carbon is formed which protects the surface of the metal. The use of sugar is to be recommended.

For stirring, a graphite or carbon rod is desirable although an iron rod may be used. Iron, however, is apt to alloy with the gold and render it hard. When all the copper and silver have melted and alloyed with the gold, which may be known by stirring, the carbon covering is removed by skimming and the whole poured into the mold. Before pour-

ing, however, give the metal a vigorous and thorough stirring in order to mix the three metals.

The mold used is made of iron and the surface should be planed smooth. The face of the mold is rubbed with a very thin coating of lard oil and fine graphite after which it is rubbed off with a rag leaving an extremely thin film of oil and graphite on the surface of it. The mold should be slightly warm in order to obtain the best results. The metal is apt to chill too rapidly in a cold mold.

The gold should be good and hot in order to cast well. It is an error to pour the gold too cold as it will not run freely and a poor casting will result. That the gold is too cold may be determined by the edges of the cast bar. If they are sharp and free from waves, it indicates that the metal was poured sufficiently hot. If, however, the edges are wavy and blunt, then the gold was too cold.

In alloying the gold, the use of some of the alloying metals in place of copper is excellent practice as they contain deoxidizing agents and give sound castings which roll without cracking.

Cause of Some of the Difficulties.

If the karat gold cracks in rolling, it may indicate that the metal was not kept well covered with carbonaceous material during the melting, or the gold was impure. In case it is impossible to roll the bar even though apparently well cast, see if the gold is not so impure that it will not roll itself.

Blisters on the surface of the rolled gold are caused by blowholes in the metal and are caused by not keeping the metal well covered with charcoal or other carbonaceous material during melting. Overheating or allowing to remain in the fire too long after melting may also cause it.

When the cast bar shows wavy lines on the surface it indicates that the metal was cast too cold.

The presence of spots in the rolled sheets of different color indicates that the metal was not thoroughly stirred.

The metal should be cast in a closed mold and not in an open ingot mold which leaves the surface to shrink down.

The surface of the rolled sheet is dirty and has white streaks on it. This indicates that the rolls are not clean.

Conclusion.

The secret in making, casting and rolling karat golds lies in two things:

1. To have pure gold in order to avoid the cracking by impurities.

2. To avoid overheating, and to keep the surface of the molten metal well covered with carbonaceous material such as sugar, in order to prevent the oxidation of the copper.

Beyond these two things, there is very little to know. The proportions of gold, silver and copper to make the various shades of gold alloys have now been carefully worked out.

Depositing Silver from its Oxalate Solution.

In making experiments* on the electrodeposition of silver, F. A. Gooch and J. P. Feiser of Yale University, New Haven, Conn., found that when it is deposited from its cyanide in the regular way using silver cyanide dissolved in potassium cyanide thus making the double potassium and silver cyanide (or the regular silver plating solution) the deposited silver contains potassium or a potassium salt. It was impossible to obtain the same weight of silver used in the experiments. The weight of the silver deposited was always greater than that used. This point is interesting as it indicates that silver deposits are never pure and contain foreign elements which may influence their tarnishing qualities.

The authors found that silver can be deposited from a solution of silver oxalate dissolved in ammonia. Nitrates can be present. The method used was to precipitate a solution of silver nitrate with one of ammonium oxalate, and then without filtering dissolve the precipitate in ammonia. In order to have an adherent and bright deposit, the ammonia should be present only in very slight excess and a low current density used. Whether the process can be used commercially is uncertain. The silver deposit also contained foreign substances but owing to the volatile nature of the substances used, they could always be driven off by heating.

*The Estimation of Silver by Electrodeposition from an Ammoniacal Solution of the Oxalate. By F. A. Gooch and J. P. Feiser. *American Journal of Science, Feb. 1911.*

The Proper Care of Tools and Machines in the Manufacture of Plumbers' Steam and Gas Brass Goods.

By Peter W. Blair.

Considerable expense and trouble have been caused to manufacturers of the above line of goods in the past ten years, owing to the amount of unskilled labor being used by them, and the adoption of labor saving tools and machines in their manufacture. I therefore contribute this article.

Before beginning work, a workman should carefully examine all his tools when received by him from the tool room, and report to his foreman if these tools are not in first class condition. If he fails to do this such defective tools must be charged against him.

Oil your machine every morning the first thing, as it works in a more satisfactory way. Under no condition use a file as a hammer, chisel or a pry. Do not use a monkey wrench for the same purpose as a hammer.

A wrench used on the head of a bolt, screw or in fact anything that has a square must fit this square closely or it will gradually round the corners.

When the chucks are put on the spindle of lathes or machines, be sure that the threads on the spindles and in the chucks are cleaned of all chips and foreign matter, and oiled. Then screw the chuck on by hand one-quarter turn of the shoulder and give it a quick turn with the hand against the shoulder, which will tighten it sufficiently to keep it in place without causing any trouble when it is taken off. At least once in every 48 hours the chucks should be oiled in their working parts.

In using collets on air chucks see that all chips are out of spindle of lathe or collet, screwing same in.

When putting jaws into a chuck, both jaws and chuck must be perfectly clean and free from chips. The chuck should then be opened up wide enough to allow the hand to pass in under the false jaws, start the screw into the jaw and screw it up as far as you can with the fingers. After inserting both jaws in this way, screw up the chuck until the false jaws come together and press firmly into the tongue and groove. This will release the chuck screw enough to allow you to tap on the face of the jaws with a piece of lead for the purpose of making them set even on the front face. Never use any hard material for this purpose for it will mar the face of the jaws. After this is done screw up the chuck screw until you have firmly gripped both jaws, then screw up both jaws tightly with a screw driver.

All working parts of the tools should be kept well oiled.

The shanks of the tools should be also oiled and wiped lightly before inserting, so as to keep them from rusting if they are left in the machine for any length of time.

All holes in turret of a machine not occupied by tools should be kept plugged up with wooden plugs, so that chips will not enter and get into the working parts.

Gauges and templets of all kinds must be handled with care. Never force a piece of work into a gauge. Do not slip a ring gauge over a set screw on your machine, for the jolting or jarring of the machine will cause it to work on the set screw and gradually spoil the gauge.

Threaded plug gauges, after you have tested your work, should be screwed into a cap, in order to keep the threads well protected.

Never accept a taper shank drill from the tool-keeper when it has a broken or distorted tang. It may become loose and damage the socket.

When taking the chuck jaws out of a chuck loosen the screws in the jaws, and if they still hang tightly insert a screw driver into the chuck and pry on the jaws, which will loosen them.

Don't start a machine without knowing everything is ready.

Don't do any unnecessary hammering on a drill press table.

Always oil the screw collar on a vise once a week if in constant use.

Don't do any hammering on any machine if it can possibly be avoided.

Don't hold a tool of any kind on an emery wheel until it gets blue.

Don't run a machine when any part of it is out of order, without notifying your foreman.

Don't forget that a cutting off tool should have equal clearance on both sides.

Don't blow filings or chips in among the running parts of a machine.

Tools must not be forced into the turret of a lathe for the reason that it is very difficult to remove them after they have been forced into position. Then, too, there is danger that the hole will be enlarged after frequent use, which would make it unfit for use with the regular tools.

Tools must fit in loosely so that they can be inserted by hand. If the tools do not fit in this way, the foreman must be called and he will see that the tools are made to fit properly.

Always see that your tools line up on center when starting a new job.

If a tool becomes fast in the turret be sure that you do not injure it or the machine in trying to remove it. Try some of the following rules and if your efforts do not meet with success call your foreman.

For Centers—If after loosening the set screw you are unable to remove the center by hand take a block of lead and tap it lightly. Do not rap it too hard as you will strain the center. If there is a flat on the center you can use a monkey wrench to give the center a turn. This, however, applies to centers in monitor lathes.

Centers in Spindles should be driven out with a rod put into the hollow of the spindle.

Tool Holders—They should be treated about the same as centers, except that you can generally get a monkey or Stillson wrench around the holder to the set screw, in order to give it a turn or use same at back to act as a wedge and force straight out.

Tap Holders—The last piece of every job should not be taken out of the chuck until you have tried to extract the tap holder from the turret. If too light to remove by hand, the tap in the holder should be screwed into this piece of work, loosen the set screw holding the tap holder in the turret, run the carriage back and pull the tap holder out of the turret. This same rule applies to the adjusting of the tap holder in or out of the turret when adjusting it to work in connection with the templet.

Die Heads—The last piece of a job should also be saved until you have determined that you can take out the die head by hand. If too tight for this purpose run the die head on to the thread, loosen the set screw that holds the die head into the turret, hold the lever of the die head, so that the chasers will not open up and run the carriage back so that die head is pulled out of the turret.

Chasers—A bar of lead or a piece of wood should be used to tap lightly the chasers that cannot be extracted from the die head.

A wrench, hammer or any hard material, such as brass, iron or steel should never be used to adjust your tools in or out of the turret, even to a fraction of an inch. Tap the tools lightly with a bar of lead whenever necessary. No hard material of any kind should land on the ways or bed of a lathe. The bed or shears should be covered with a smooth board.

When putting a tool in the turret or holders special care should be taken to turn the flat side of the shank so that the set screw will rest on it. If the set screw is screwed down on the round part of the shank it will spread out the shank and cause a lump to appear, which will cause the shank to fit tightly in the hole. The set screw should never be allowed to rest on the extreme end of the shank for it will tip the tool out of the center and allow it to creep from under the set screw, and run shank on end.

Always use square hard wood or lead block when taking off a box-chuck.

Don't be contented with just knowing what "Shop Kinks" you have learned from someone else, but investigate and work out a few for yourself.

Uselessness of Phosphorus in Lead Base Alloys.

The fact that phosphorus is so extensively used in tin alloys such as the tin bronzes, and is so efficacious in liquefying thick tin, has led makers of white metal mixtures to try it in the lead base alloys, such as antimonial-lead or low grade solders. It has not been found of value, however, and as far as known, it is not employed.

The addition of phosphorus does not appear to change the character of the lead alloys so that its introduction is not attended with any good results. In this respect its effect is opposite to that obtained in tin. Strictly speaking, phosphorus is not a *natural* addition to the lead alloys for the purpose of deoxidizing. On the other hand, arsenic (which is an element chemically analagous to phosphorus) will act as a deoxidizer and is frequently used for this purpose. It is, however, rarely necessary or used for the reason that most antimonial-lead contains it in a greater or less amount.

The Electroplating of Rusty Iron or Steel.

The electroplating of rusty iron or steel is not a very satisfactory operation but there are many instances in which it has to be done. There are various degrees of rust on such goods, ranging all the way from those which are corroded so badly that they are almost useless up to ones that are slightly rusty. Whether it is good policy to attempt to plate such goods remains with their character and cost. Very cheap articles should be thrown in the scrap heap. Expensive goods must be plated. In many instances, too, the rust is not sufficient to render the plating difficult or expensive.

Let it be said at the beginning, if the goods are of such character that the surface can be polished or ground down to remove the rust, then by all means do it as this renders the article as good as new. This cannot always be done, however, as the cost or the shape of the article may be such as to prevent it.

It has been found that if the rusty iron or steel article be first soaked for some time in a strong, hot caustic potash or caustic soda solution (the stronger and hotter the better), the rust will be softened so that it is far more readily attacked by the acid used for the subsequent pickling. This has been found one of the excellent discoveries that has been made recently and was discovered by accident. It makes no difference whether the article is greasy or not, soak it in the potash or soda solution just the same. The solution should be as hot and as strong as it is possible to make it and the article is allowed to remain in it for from half an hour to one hour or longer. A prolonged soaking does no harm and is excellent.

The potash or soda solution decomposes the rust but of course does not remove it. It simply renders it of such a character that the pickling acid attacks and dissolves it more readily and before the iron or steel is attacked by the acid to any great extent. When the potash or soda solution is not used, the rust seems to resist the action of the acid tenaciously, and although it finally dissolves in the pickling acid, it remains so long undissolved that the iron or steel may be badly attacked in the meantime.

In pickling rusty iron or steel, use muriatic acid whenever possible. It is the best solvent for iron rust and is far superior to sulphuric acid. Do not use it too strong. The best results are obtained by using it weak and giving the operation plenty of time. The following proportions are recommended:

Water	4 gallons
Muriatic Acid	1 gallon

When this solution is used, there is little gas given off from the articles. This indicates that there is little action on the metal, but that the rust is slowly going into solution. There is then little pitting. Warm solutions work more rapidly than cold.

When all the rust has been dissolved by the pickle, rinse the articles and then immerse in a sal-soda solution (without drying them) until wanted for plating. This will prevent any further rusting and will serve to neutralize any acid left in the pores of the iron or steel. The sal-soda solution is made as follows:

Water	1 gallon
Sal-soda	4 oz.

When the plating is to be carried out, the articles are removed from the sal-soda solution (without rinsing) and scrubbed with pumice and water to remove any film of carbon or rust that may be on the surface. It frequently happens that small particles of rust may be on the surface after pickling, although soft and readily detached. Scrubbing with the pumice will remove them.

By not rinsing off the sal-soda solution the iron or steel is prevented from rusting. *In handling iron or steel for plating, never allow the surface to become dry.* It then readily rusts, but when kept wet, it may be prevented from doing so for some time, and even if it should, the thin film may readily be removed by dipping in the pickle again.

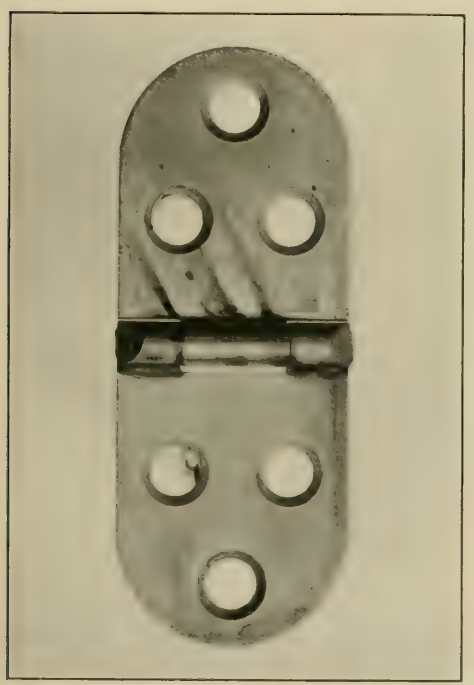
When the rust has been removed and the surface scoured with pumice, the plating may be carried out at once without any further treatment.

Platinum enters the United States free of duty and the demand is rapidly increasing with a corresponding increase in price. During the first eight months of 1910, 77,637 oz. with a value of $2,057,446 were imported. Only about half as much was imported in the same period of 1909. So far, there has been found no substitute for it.

Streaks on Electroplated Articles.

In electroplating goods of particular kinds it frequently happens that streaks are found on the surface after the plating operation has been completed. They are comet shaped marks which start from some particular location and extend upwards. They will always be found in such a direction.

These streaks are noticed particularly on work that has cavities in it and they invariably start from this location. In the illustration is shown a hinge that has been brass plated. The streaks are quite noticeable. They start from the joint and pass upwards.



Brass Plated Steel Hinge Showing the Streaks.

The cause of such streaks is always the imperfect cleaning of the article. Polishing or buffing dirt fills the cavity and then works out when the plating operation is carried on. It may also be caused by the cleaning solution, such as potash, remaining in the cavity. This, too, will gradually work out during the plating operation and cause the streaks.

The streaks may come in any solution under such as those previously mentioned, and in the case of the hinges herewith illustrated, they were found on both brass plated and nickel plated goods.

The method of preventing the streaks, therefore, is to wash out the polished or buffed work in a suitable soap solution, and then be careful to rinse thoroughly in clean water before going into the plating bath. In other words, the cavities, joints holes, etc., must be freed from all foreign matter.

Establishing Standards in the Manufacture of Plumbers' Brass Goods.

At the meeting of the National Association of Brass Manufacturers, held in Chicago, Ill., on Mar. 28th and 29th, it was voted to cooperate with the U. S. Bureau of Standards of Washington with a view to establishing uniform patterns, designs, threads etc., for goods in the brass lines used by the Government. A committee was appointed for this purpose.

The so-called "Pittsburgh-gauge hose thread" was a subject of discussion and it was decided to do away with it. The following resolutions were provided for this purpose:

WHEREAS, The arbitrary thread, commonly known as the Pittsburg gauge hose thread, having served its purpose, and in a sense become burdensome, as it requires the carrying of duplicate stock, and in the language of some of the Pittsburg jobbers has become an imposition to the trade and a nuisance; and,

WHEREAS, We have the united wish of the Pittsburg jobbing trade that we do away with same, and refuse to make or sell brass goods with this odd or arbitrary thread in the future,

Therefore, be it Resolved, That we recognize the wishes of the Pittsburg jobbing trade and comply with their unanimous opinion and views in this matter, and we hereby pledge ourselves not to make or sell brass goods with this gauge or thread after September 1, 1911; and be it

Further Resolved, That we instruct the commissioner to take this matter up with the manufacturers of hose brass goods who are largely interested, and brass manufacturers not members of this organization, with a view of securing their assistance, and that in doing so that he ask the co-operation of the Pittsburg jobbing trade.

The Association is composed of manufacturers of plumbers' brass goods, steam goods and similar products.

The Fusion Welding of Copper.

The January number of the *Revue de la Soudure Autogene* contains an interesting article by M. R. Amédéo on the application of the process of fusion welding to copper, especially with the aid of the oxy-acetylene blowpipe. Much is hoped from the process in the manufacture of autoclaves and distilling apparatus, though it has to be admitted that many of the attempts hitherto made have not been very successful, the joints breaking rather easily in some cases under quite slight provocation.

Some have endeavoured to improve the quality of the joints by modifying the character of the flame. With a slight excess of acetylene one should obtain a joint free from all trace of oxidation. Others have, however, proposed using a flame having a slight excess of oxygen.

A flame with a larger proportion of acetylene than is normally the case undoubtedly produces carbon monoxide and hydrogen in greater quantities, and as both these gases are reducing agents, the chances of oxidation are eliminated. Unfortunately, however, carbon monoxide and hydrogen are both soluble in copper, so that their presence causes an increase in the blow-holes in the metal of the joint. As to the use of an oxidising flame, it can be left to those who desire a joint made of an alloy of copper and its oxide.

Most metals when fused under the blowpipe dissolve the gaseous products of combustion, and on cooling more or less numerous blow-holes make their appearance, whilst despite the incontestable reducing action of the flame, some of the metallic oxide is produced and dissolves in the molten metal. These physical and chemical phenomena attain an exceptional intensity in the case of copper, and if one welds red copper, using electrolytic copper wire for the metal of the joint, it is found afterwards that the latter is spongy, a fact soon detected on treating with nitric acid. The density of the metal on the line of welding is frequently diminished by 10 to 15 per cent. To avoid transforming the welded parts into a sponge, many workshops use as welding metal rods of copper alloyed with 10 per cent. of zinc; the joints produced in this way are free from blow-holes, as can be shown on treatment with nitric acid. The alloys of copper with a slight proportion of tin also give perfect joints, and the metal on chamfering is found to be destitute of elasticity. A good many of these alloys have been sold during the past few years and have possibly brought discredit on the fusion-welding of copper, since the joints produced have certainly not been obtained by *autogenous* welding, an alloy being used in their formation.

The *Union de la Soudere Autogene,* having paid considerable attention to the autogenous welding of copper, have dismissed as useless alterations made in the flame with the object of adding less metal. On the other hand very encouraging results have been obtained by using reducing agents which could be readily applied, especially phosphorus.

Those who have worked with copper have noted that the parts of the plates in the neighbourhood of the joint lose their toughness, and break easily. In such cases the metal has been burnt, but this burning is only an internal oxidation, which is always occasioned when copper is heated to a high temperature in contact with the air. The oxidation first takes place superficially, but the oxide produced dissolves in the metal, becoming in this way disseminated. During its passage it oxidises some of the copper to the state of cuprous oxide.

The wide variations recorded with regard to the melting point of copper are to be attributed to this formation of dissolved oxide. When copper is heated in contact with air it melts at 1065°C., whilst when pure it fuses about 1090°. The melting point which one observes in practice is really that of a eutectic alloy of copper and cuprous oxide. Even under the blow-pipe there is always a considerable area of fused metal which escapes the reducing zone of the flame, and on this account it is necesary to employ a de-oxidant if it is desired to get a line of welding free from oxidation.

A number of substances, generally as powders, have been recommended for hindering the solution of gases by the molten metal with subsequent production of blow-holes, but most of the results have been very irregular. The use, however, of a phosphorus-copper alloy assures perfect de-oxidation on the line of welding, and further, the products of the oxidation of the phosphorus cover the fused metal and prevent the solution of gases of combustion taking place.

Some of the results appear to have been excellent. M. Amédéo states that copper sheets

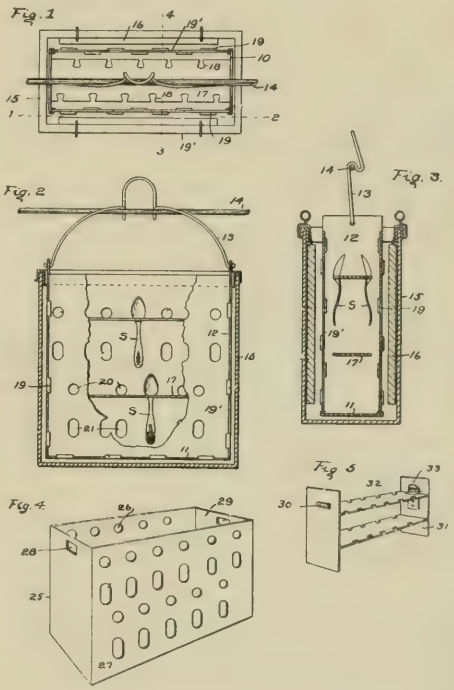
of 15 mm. thickness after fusion welding are sufficiently malleable and ductile to be worked in the ordinary way. The addition of phosphorus to copper necessitates great care if the metal to be added during the welding process is to have a constant composition. Whilst the actual welding can be effected without difficulty, provided the right composition has been attained, the real difficulty lies in manufacturing a suitable metal for the addition, as the quantity of phosphorus added must be very small but nevertheless evenly distributed. An excess of phosphrous above that necessary for the deoxidation entails some of this element being left in the metal along the welding line, and attention should be drawn to the marked way in which the mechanical properties of phosphorus are altered even by the addition of quite small amounts of phosphorus.—*The Ironmonger.*

A New Form of Rack for Section Plating of Flat-Ware.

A new form of plating rack for the sectional silver plating of spoons and forks has been patented by Wm. H. Rogers of Muncie, Ind., the well known manufacturer of silver plated ware. The rack is intended for the silver plating of flat-ware so that a heavier deposit may be placed on the bottom of the bowl and handle (the portions of a spoon which receive the greatest wear). The rack is herewith shown:

Referring to the drawings, in which like reference characters indicate like parts, I provide frame 10 formed of suitable electroconducting material, the frame having a bottom 11 and upright end pieces 12, a hanger or handle 13 being engaged in the upper portions of the two ends 12, by which the rack is supported from a conductor 14, which conductor is supported above a tank 15, in which the rack is submerged in operation. The conductor 14 is connected to an electric circuit in the usual manner and handle or hanger 13 is also a conductor of electricity so that frame 10 becomes the cathode of the circuit. Suitable anodes 16 are suitably suspended within the tank on opposite sides of the rack 10 and are also connected to the electric circuit.

Extending transversely between ends 12 and secured thereto are any number of supports or shelves 17 of suitable electroconducting material. The side edges of these shelves are notched at suitable intervals to receive and retain the articles to be plated. In the drawings I show the notches 18 of tapering formation so as to support spoons S, and the notches on one edge of the shelf are staggered relative to those on the opposite edge. The bowls of the spoons preferably face inwardly, thereby presenting the backs of the spoons towards the anodes 16.



Roger's Rack for Plating Flat-Ware.

The sides of the rack 10 are open, but the edges of the ends 12 and bottom 11 are provided with suitable guides or cleats 19, between which are slidably arranged two side plates 19' which are formed of a suitable insulating material such as rubber or fiber, or any other material which will tend to protect the interior of the rack from the electric current passing from the anodes to the articles suspended on shelves 17. These side plates 19' are provided with suitable openings 20 opposite the points on the articles where the greatest amount of metal is desired to be deposited on the articles which are suspended on the shelves 17. In the drawings, since spoons are the articles shown, the openings 20

are opposite the back of the bowls of the spoons and openings 21 are opposite the backs or such portions thereof as it is desired to expose to the anodes. It is evident that the openings in sides 19' may be of any form and located therein at any desired points and that any number of shelves or supports 17 of any suitable form may be attached to ends 12 and that the notches in the shelves may have any form suitable to support the article to be plated. In practice rack 10 and the portions of the hanger 13 which may be within the bath will be provided with an insulating coat of suitable material, so as to prevent the deposit of the metal on those parts.

It is now apparent that the current of electricity will pass from the anodes through the liquid to the articles supported on rack 10, but since the insulating plates 19' are between the anodes and the articles the portion of the articles opposite the openings receive the full force of the current while the remaining portions of the articles receive less force; consequently a heavier deposit of the metal in the bath will be made on the exposed portions of the articles than that received by the insulated portions. It is further apparent that the rack is easily loaded with the articles by simply withdrawing the insulating sides 19', whereupon the articles may be easily inserted in the notches of the supports 17.

Notes on Electrogalvanizing.

O. Hildebrand in *Elektrochem. Zeits.* makes some comments on electrogalvanizing. He says that the difficulties in the way are caused by:

1. The inconvenience of having entirely to surround the article to be treated with zinc anodes.

2. The poor adherence of the electrodeposited zinc.

In the so-called "regenerative method", the anode is of lead and the electrolyte a solution of sulphate of zinc acidified with sulphuric acid. The solution is continuously circulated through the tank and then through a regeneration vat containing zinc dust before it returns to the tank. Rapid neutralization of the free sulphuric acid in the solution then takes place owing to the good contact with the finely powdered zinc dust. In such a solution for electrogalvanizing the zinc deposit is very pure, adherent and uniform.

Tricks in the Scrap Metal Trade.

Third Paper.

Pickling Washings.

The sale of washings is not carried on at the present time to the extent that it was at one time, but there is still a considerable trade in them among scrap metal dealers. The term "washings" is used to designate the metal left in washing out the coal and slag from brass foundry ashes. Washings of this kind, when they come from brass foundries making red metal castings alone, (such as, for example, steam metal valves), are always a desirable material and can be used in the making of composition castings.

As such washings have usually been sold by the appearance, it is customary to wash them quite clean and then, if they are entirely uniform in color and red, they command a good price. If, however, they are mixed with yellow brass washings, even in a small amount, the yellow color is so conspicuous that the whole material cannot be sold for red washings, but comes under the head of "mixed washings" and the price which they will bring is much lower.

In order to change the color of these yellow washings before they are mixed with the red ones, they are "pickled". By doing this the surface of the yellow metal is changed to red. The method followed is simply to pickle the yellow washings in weak sulphuric acid (oil of vitriol). About 9 parts of water and 1 part of sulphuric acid are used. The washings are immersed in it until the zinc in the brass is dissolved out leaving the copper on the surface. This, of course, takes place only superficially, but still it is sufficient to color the washings. The pickling operation may take several hours if the pickle is cold, but if hot it acts very rapidly and the red color is obtained in a few minutes. The washings are then rinsed in water and they will have a red color.

The yellow brass washings thus colored red on the surface are mixed with the red washings so that the whole lot has a uniform, red color. The practice is, of course, legitimate in one way, but is dangerous in another. Yellow washings are now rarely good on account of the extensive use of aluminum in making yelow brass castings. Aluminum is

never used in the red metals. By thus mixing the yellow washings with the red, aluminum may be introduced. Were it not for the aluminum, the red washings might melt to a red ingot, even though containing a small amount of yellow metal, but the presence of aluminum ruins the whole lot for any purpose that can be found for red brass except the cheapest class of railroad work and even in this it cannot always be used.

New Books.

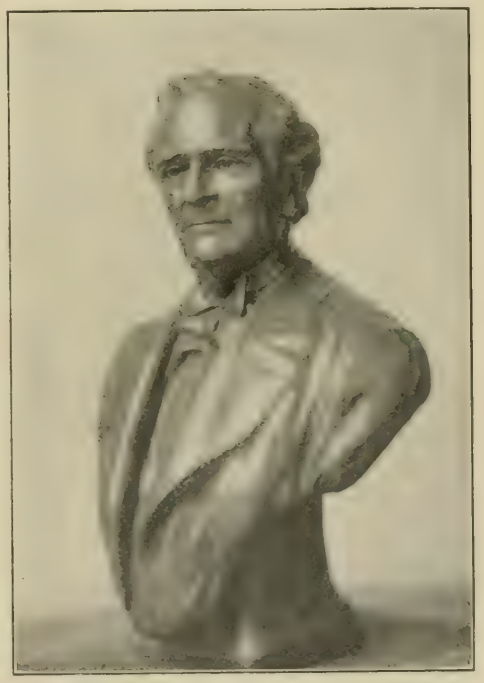
METAL WORK AND ETCHING, by John D. Adams. A complete manual for art metal workers giving every detail for making a great variety of useful and ornamental objects such as book ends, desk sets, pad corners, paper knives and letter openers and a large variety of similar objects. This book is one of the series of twenty-five cent treatises published by Popular Mechanics. The book is written in a very plain manner so that anyone can understand it. 96 pages, 5 x 7 inches cloth bound. 49 illustrations. Price, 25 cents, postage paid. *Popular Mechanics Co., Chicago, Ill.*

MOTION STUDY, By Frank B. Gilbreth (Member of the American Society of Mechanical Engineers), with an introduction by Robert Thurston Kent, (Editor of "Industrial Engineering"). This book has a misleading title and is not, as the title would indicate, devoted to aeronautics. It is a book out of the usual line and treats upon and discusses the actual motion followed in working, and the best practice to follow in order to obtain the greatest output of a workman. As an example of economy in labor, bricklaying is cited. If the bricklayer stops to pick up the bricks from the scaffold floor, he cannot lay as many as though the bricks were placed within easy reach. The book carefully discusses the method of economizing labor by standardizing the motions of the workmen performing it. 116 pages, 5½ x 8 inches. 44 illustrations. Cloth bound. Price, $2.00, postage paid. *D. Van Nostrand Co., 23 Murray St., New York City.*

Voltmeters, especially of the cheap type, should be tested from time to time as they are apt to become inaccurate. They all contain a permanent magnet which loses its magnetism and the readings are then erroneous.

Use of Copper Plated Plaster Instead of Bronze.

As a substitute for solid bronze castings in art work, metallized plaster of Paris has always been attractive. The difficulties in the way of metallizing the plaster have been such, however, that few have attempted it. L. G. Delamothe, 1381 Broadway, Oakland, Cal., has been very successful in plating non-metallic objects, and he is well known as the pioneer in making hat pins of metallized roses. He has recently turned his attention to metalliz-



Copper Plated Plaster of Paris Bust.

ing plaster of Paris and a successful result was described in THE BRASS WORLD some time ago. Mr. Delamothe has recently metallized a much larger plaster bust than has ever before been attempted and which is herewith shown. This bust was first made in plaster of Paris and then copper plated with a heavy copper deposit. The result of the treatment is herewith illustrated in order to show the application and possibilities of the process. A plaster cast thus metallized is as durable and has the appearance of bronze and at a very much less cost.

Aluminum in Automobile Work.

In the *Cycle and Automobile Trade Journal,* Henry Souther of the Henry Souther Engineering Company of Hartford, Conn., has contributed an interesting article on aluminum. He says:

The aluminum casting is now so well established in the automobile field as to attract little comment from the layman and require but little study by the engineer designer. It fills a long-felt want; and is but one-third as heavy as a steel casting and possesses one-third the strength—10,000 to 12,000 lbs. per square inch elastic limit for the aluminum casting as against 30,000 lbs. per square inch elastic limit for the steel casting.

The source of the ingot aluminum and its alloys in ingot form fortunately is and has been a good and reliable one. The management has wisely maintained a careful and scientific control of the output. Meanwhile, the price for aluminum and its alloys has declined steadily without loss of quality.

According to figures from the Aluminum Co., of America, the following were the prices from 1865 up to 1895.

Year	Price	Year	Price
1856	$90.00 per lb.	1891	$1.00 per lb.
1862	12.00 per lb.	1893	.75 per lb.
1886	5.00 per lb.	1894	.50 per lb.
1890	1.50 per lb.	1895	.35 per lb.

The average prices for the past twenty years were as follows:

1890	$ 1.50 per lb.	1903	$0.31 per lb.
1891	1.00 per lb.	1904	.30 per lb.
1893	.75 per lb.	1905	.32 per lb.
1894	.50 per lb.	1906	.36 per lb.
1895	.35 per lb.	1907	.45 per lb.
1900	.32 per lb.	1908	.39 per lb.
1901	.31 per lb.	1909	.24 per lb.
1902	.31 per lb.	1910	.23 per lb.

It is interesting to note that the price of aluminum in 1856 was $90 per pound, and that its quality was in no way superior to that obtainable today for 23 cents per pound.

In 1906, 1907 and 1908 it will be seen that the price advanced considerably. This was due largely to two causes; the relatively high cost of copper during that period and consequent increased use of aluminum in electrical work, and the heavy demands of the automobile manufacturer.

With the source of supply that exists, many foundries are able to procure sound and reliable material for the production of their castings. Only by wilful admixture of inferior stock, such as dirty scrap or cheap alloying metals, is it likely that the consumer will receive poor metal in his castings, as, for example, a cheaper alloy—a counterfeit. Of course the best of ingot metal may be ruined by improper melting practices. Aluminum oxidizes very rapidly in a melted or partially melted state, and a casting poured from such oxidized metal cannot be a good one. A good melter will guard against this defect with the utmost care; an inexperienced one will give it little thought perhaps, and under the influence of old habits may melt as carelessly as with copper, lead and zinc. Naturally, the best source of supply for aluminum castings is an experienced and reliable foundry.

Aluminum Alloys.

There are a number of aluminum alloys, but those most useful for automobile purposes are:

—A—

Aluminum	92%
Copper	8%

This alloy is a good one. It contains no zinc and for this reason is preferred by many to the second or "B" alloy, even in the face of the fact that it is the weaker as regards tensile strength. The specific gravity of this alloy is 2.85 and the tensile strength 18.000 lbs. per sq. in.

—B—

Aluminum	82%
Zinc	15%
Copper	3%

This alloy has a specific gravity of 3.10 and a tensile strength of 22,000 lbs. per sq. in.

—C—

Aluminum	65%
Zinc	35%

The specific gravity of this alloy is 3.30 and it has a tensile strength of 35,000 lbs. per sq. in.

Each of the foregoing alloys has a field of usefulness, with A and B close rivals as to which is the better for the most important castings entering into automobile construction. The third or C alloy is a heavy one. It is good for trim castings, for floor boards, foot boards and the like. It possesses a good color and is easy to keep clean.

Pure aluminum is used where lightness is supreme and strength of but little moment. The gain in weight over the first alloy given above is small (specific gravity of 98 per cent. aluminum about 2.70); so that it may be said that the use of pure aluminum for automobile castings is not important.

It is stated that the zinc alloy fails under vibration and shock earlier than the non-zinc alloys, but many tests fail to confirm such belief. The results of a series of tests conducted on the White-Souther endurance testing machine are given:

Alloys used in the tests:

Number	1	2	3	4	5
Aluminum	92.05%	83.42%	91.12%	81.20%	83.75%
Zinc	none	16.24%	none	15.20%	16.24%
Copper	7.84%	0.34%	8.86%	3.06%	none
Manganese	0.11%	none	0.02%	0.54%	0.01%
Specific Gravity	2.84	2.97	2.88	3.08	2.94

The results obtained in the endurance tests on the machine were as follows:

Revolutions endured before failure of the test piece (at 1300 revolutions per minute):

Alloy No.	Revolutions
1	816,500
2	1,618,300
3	507,200
4	327,100
5	9,980,800

The figures as to tensile strength for the three aluminum alloys first mentioned (A, B and C) are those obtained from normal test specimens (not chilled, and not cooled slowly, or annealed and of reasonable thickness—about half inch flat or round). The most desirable specimen for tensile test is the form recommended by the Society of Automobile Engineers, and also by the American Society for Testing Materials, from which it will be observed that this specimen is screw ended, for securely attaching to the grips of the testing machine. To prevent all strains other than tension, the grips must be supported by ball and socket joints or some other good equivalent. Without these common sense precautions, uniform and reliable results cannot be obtained.

Aluminum alloys, like others, should be cooled quickly to get the soundest and strongest castings. Very slowly cooled metal forms large crystals that do not knit into a tenacious mass. Quickly cooled metal solidifies into a mass of fine crystals that interlace and tend to produce a tough and strong casting. For example, 98 per cent. aluminum (specific gravity 2.70) when cooled slowly will possess a tensile strength not far from 8,000 lbs. per square inch. If this same metal be cooled quickly, it will possess a strength of about 12,000 lbs. per square inch.

A thick specimen cools slowly and is soft and weak. A thin specimen is hard from quick cooling, and may also be brittle and weak from internal cooling strains. The influence of thickness in aluminum castings is well shown by a series of tests conducted by the writer for this purpose.

Beware of the test coupon attached to a part cast in sand with the coupon cast in metal chills or otherwise quickly cooled. Such a coupon does not fairly represent the casting to which it is attached, the casting being the weaker.

Eight test pieces, varying in thickness from ⅛ inch to 1 inch, and 1 inch in width were cast from one ladle into one mold through one gate. The following results were obtained from tensile tests made on these specimens:

Thickness	Strength per sq. in.
⅛"	27,000 lbs.
¼"	25,700 lbs.
⅜"	22,200 lbs.
½"	22,800 lbs.
⅝"	22,400 lbs.
¾"	21,200 lbs.
⅞"	21,700 lbs.
1"	18,800 lbc.

The alloy used for these tests was:

Aluminum	81.42%
Zinc	16.10%
Copper	2.48%
Specific Gravity	3.01

The fracture of a good casting must be clean first and fine-grained second. By

"clean" is meant freedom from particles or spots of the dark colored oxide of aluminum. A bad casting will have them and they may be easily seen with the naked eye.

Although aluminum alloys are not as strong as good gray iron castings, they may be used where iron is unsafe if of similar thickness and design. This statement must not be depended upon for such parts as are to be subjected to heat. The melting point of iron is approximately 2200 deg. F. and that of aluminum about 1150 deg. F. Heating to a temperature of 500 deg. F. materially weakens aluminum, but not cast iron. Below are shown the results of a few tests made to determine the effect of different temperatures on an aluminum mixture similar to alloy (C) hereinbefore mentioned:

room temp. approx. 70 deg. F.	heated to 400 deg. F.	heated to 500 deg. F.	
35,700	23,100	16,900	(cast from same ladle)
36,500	24,700		(cast from same ladle)
35,000	22,800	15,300	(cast from same ladle)
31,300		14,100	(cast from same ladle)

While cast aluminum endures better under dynamic loads than cast iron, a tensile test does not reveal such toughness as is indicated by the deflection and endurance under dynamic tests. In many cases the elastic limit is lacking or coincident with the maximum strength.

As with all castings, the design of a piece must be carefully studied in order to obtain the best relation of thickness between adjacent portions, of easy fillets and corners of uselessly thick or thin areas of metal.

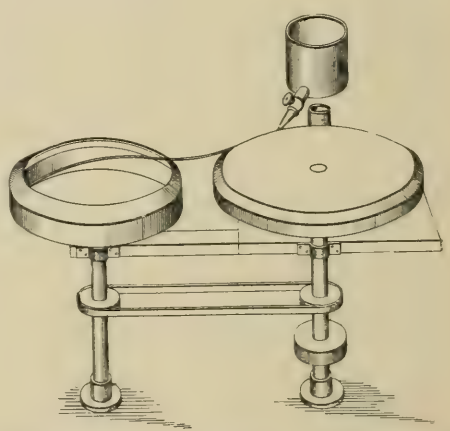
In conclusion; that cast aluminum is a most useful metal is proven by its widespread and successful use—and surely there is no metal for structural purposes more attractive or pleasing to the eye.

For tin, or tin alloys rosin is the best and cheapest flux to use when melting them as it dissolves the oxide that forms and gives clean metal.

The strength and elongation of aluminum castings are increased by chilling the molten metal in the mold. The rapid cooling which then follows greatly influences the casting and it becomes stronger and more ductile.

An Apparatus for Making Soft Metal Strands or Wire.

A new form of apparatus for making soft metal strands, ribbons or wire has been patented by Willard G. Staples of Newburyport, Mass. (U. S. Patent 989,075, Apr. 11, 1911). The metal is melted in the reservoir at the top of the right hand wheel. When this has been done it is allowed to flow on to the periphery of the right hand wheel. This wheel is revolved by any suitable method, either by a belt as shown in the illustration or a motor. The molten metal, flowing upon the surface is spun out into a more or less thread-like form. It then is thrown off by centrifugal motion and flies into the interior of the left hand wheel where it cools and is coiled up.



Staples's Apparatus for Making Soft Metal Strands.

By adjusting the size of the stream of the molten metal, which flows on to the first wheel, and also the speed of the latter, a coarse or fine thread or wire may be obtained. By making the surface of the right hand wheel, upon which the metal first flows, figured, a figured metal strand may be obtained. The strand produced is continuous.

The peeling of lacquer is usually caused by the imperfect cleaning of the metal surface before lacquering, although it may be caused by the use of a lacquer not adapted for the purpose. Lacquers containing "gums", in addition to the regular pyroxylin base, hold more tenaciously although not as tough as a straight pyroxylin lacquer.

Mixtures for Making Fine Yellow Brass Castings.

The making of fine and intricate yellow brass castings is a much more difficult job than making the same castings in red metal. Much depends upon the mixture.

The usual difficulty is in the use of too much spelter in the metal. This causes the metal to come dirty in the castings so that when dipped, spots show. As a usual rule, fine yellow brass castings bring a good price and there is no occasion to economize on the metal. The labor is the principal item. For example, take such work as the fine yellow brass art metal wares that are now being produced and which are made of castings. The difference in cost between a suitable brass mixture and one that is cheap and unsuitable is so slight that it can scarcely be taken into consideration. The use of the best possible mixture is advocated unless the price will not stand it or there is no demand for good work.

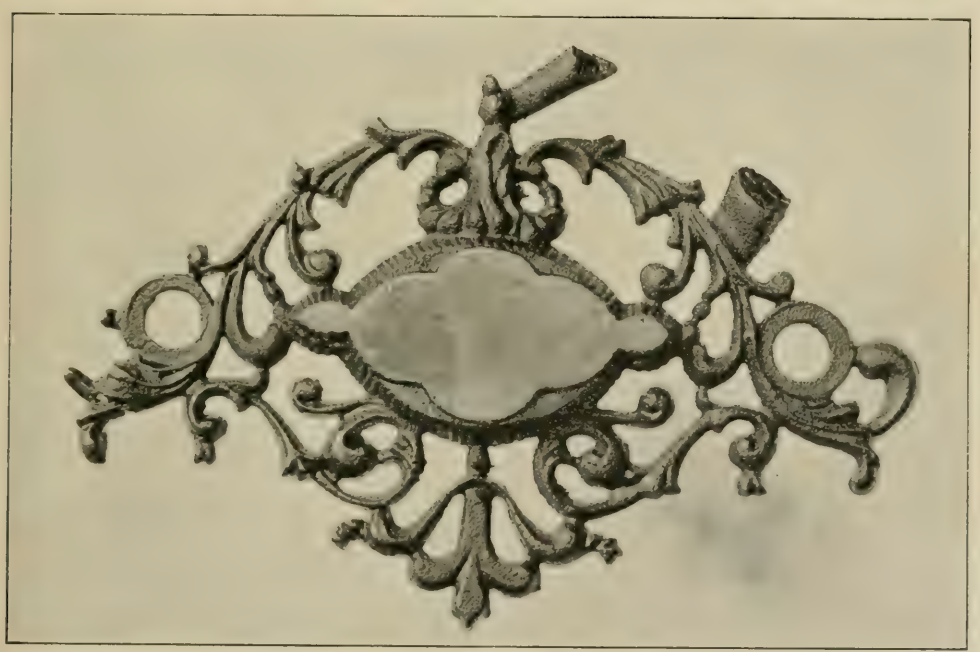
The so-called low brasses are the ones most suitable for making art metal castings as they have a very pleasing greenish-yellow shade not found in the high brasses. For the best class of work the following is recommended:

Copper	75 lbs.
Zinc	23 lbs.
Tin	2 lbs.

Unless there is machine work to be done on the castings, the use of lead is not advocated as it does not give as good a surface on the casting. As a usual rule, the castings are dipped and when no lead is used a better dipped surface can be obtained. In case there is machine work to be done, the metal will be too tough without lead and about 2 lbs. to 100 lbs. of mixture should be introduced.

The molds for fine brass work should be skin dried by placing the face of the mold near a hot stove. Then clamp it together and pour the brass with the mold on end. For such work as that herewith illustrated, the use of aluminum and pouring flat is not to be recommended as the castings will rarely run unless poured very hot and they will then come dirty.

For facing the mold Windsor-Locks sand or its euqivalent is to be recommended as it produces a fine surface on the casting. In case an extra fine surface is desired on the mold, the face is smoked by a gasoline torch (a piece of waste soaked in gasoline and held under the mold while burning) after skin drying.



Example of Yellow Brass Casting Demanding Good Metal of the Right Color.

Bakelite; A New Substance for Solid Materials, Varnishes and Lacquer.

Bakelite is a new substance which, in different forms, offers the advantages of hard rubber, Japanese lacquer, celluloid, and in some respects excels the properties of these products. It is not merely a mixture like so many rubber, shellac or other resinous compounds, but a well defined chemical substance of specific properties. It has some relation to the subtle process which in the Japanese lacquer tree engenders the substance known under the name of Japanese lacquer. Up till now, the latter has been a product of limited applications, and an article of luxury, on account of its excessive price, and scant supply. Bakelite, however, can be manufactured in practically unlimited quantities and at a price which allows of a wide range of uses. The laboratory method is an improvement on nature's process, not only because the reaction is quicker and less expensive, but the artificial product is decidedly more resisting to chemical and physical influences.

Bakelite is the invention of Dr. Leo H. Baekeland who is one of the foremost inventors of the age. He is the inventor of the so-caled "Velox Paper" which has so simplified photography and rendered it possible to print from negatives by artificial light. This paper is now universally used by both professionals and amateurs. Dr. Baekeland is also president of the American Electrochemical Society.

Dr. Baekeland first presented an account of his discovery of "Bakelite" and its industrial applications before the New York Section of the American Chemical Society on February 7th, 1909. Since that time various patents have been obtained so that the process has been amply protected.

The method of making "Bakelite" is to cause carbolic acid (phenol) and formaldehyde to react with one another. It is strange that two pungent and ill smelling substances should unite to form a material that is transparent and amber-like in color, and entirely devoid of odor and taste. Such is chemical reaction and while remarkable, indicates the possibilities of making substances synthetically.

Various grades of "Bakelite" are produced and all of which are remarkable. For example, one of the products is a solid material which is insoluble in acids, oil, steam, hot water and can stand a temperature of 572° F. (300°C.) without change. This property renders it exceptionally valuable for electrical work and many other uses as it is an excellent insulator. It can be used to impregnate wood and other substances rendering them harder and more resisting. It can be obtained as transparent as glass or colored to suit different cases. It is much harder than celluloid or hard rubber. It is not inflammable like celluloid nor is decomposed by heat like hard rubber.

Other grades are made which can be molded into various shapes as desired when first made so that a great diversity of shapes may be produced as the trade demands.

The "Bakelite" varnish is made by dissolving one of the suitable grades in alcohol and is applied as any varnish would be. A hard, resistant coating is thus obtained which, while having all the ease of application and drying qualities of spirit varnishes, leaves a coating of an enamel-like substance which is as hard or harder than Chinese or Japanese lacquer, and is not affected by water even when hot. The great advantage of such a varnish is at once apparent and has never yet been obtained. It is probable that this varnish will be one of the most extensively used of the "Bakelite" products.

The lacquer which is made from "Bakelite" is similar to the varnish, but is thinner and dries more slowly. It is applied like any lacquer and is allowed to dry spontaneously, after which it is baked to about 266° F. until the so-called "C" condition of the "Bakelite" has been obtained. A very hard coating is thus obtained which is not easily scratched or attacked by acetone; in fact, these resisting properties are the tests applied to ascertain when the change has taken place by the baking.

The lacquer is transparent, and its color can be made to vary from a slightly yellowish tint to a deep brown. It lacks the flexibility of the nitrocellulose lacquers, but, on the other hand, it will resist high temperatures that would destroy this material. In addition it stands the action of solvents that attack and destroy other lacquers. In order to apply the lacquer made of "Bakelite", the surface must be previously freed from grease as any metal surface would be for the application of other lacquers.

The lacquer can be brought to a very pleasing golden color. Darker tints may be obtained by stronger heating. These colors do not bleach out under the action of the light and are permanent. Such a property renders the use of the lacquers very advantageous in coloring the surface of metal goods, as no dye is used.

Some of the other products of "Bakelite" are enamels, impregnated wood, adhesive cement, plastic mixtures and "Bakelite" paper. All classes of "Bakelite" products are now being manufactured by the General Bakelite Co., 100 William St., New York City. There is no doubt that the future will find the various products very extensively used and for classes of work not heretofore touched. In other words "Bakelite" is an entirely new product and there are very few manufacturers who will not find some place where it can be employed to an excellent advantage.

New Method of Treating Aluminum for Soldering.

According to an English patent recently granted to L. Maitre of Predame, Switzerland, aluminum is prepared for soldering in a satisfactory manner by first depositing a thin layer of iron on the surface. It is then immediately plunged into boiling water and then into cold water. It is then reheated until the deposit has acquired a blue color when it is again immersed in cold water in the manner that steel would be hardened. It is stated that this treatment has the advantage of causing the iron deposit to adhere more strongly to the aluminum base.

The film of blue oxide is now removed from the surface of the iron deposit on the aluminum by means of fine emery cloth, and is ready for soldering. The soldering is done by any regular method.

The standard flux for zinc is sal-ammoniac as it has the property of decomposing the oxide of zinc which forms on the surface, producing chloride of zinc which floats on the metal and may be skimmed off leaving clean zinc.

On the Preparation and Properties of Boron.*

By E. Weintraub.

I want to describe to you to-night the properties of the element boron isolated in pure fused form in the West Lynn Research Laboratory of the General Electric Company and also to give you in brief the methods used for the preparation of the element and a survey of its possible applications.

I have here a large lump of fused boron, small broken up pieces to show you the fracture and also a bottle filled with crushed boron.

Both in appearance and in its curved conchoidal fracture the lump and the broken up pieces most nearly resemble black diamond. They are very hard and scratch with ease the known hard substances except diamond. The surface is a very shiny black and takes a beautiful polish.

To my knowledge this is the first artificial product (not an imitation of a natural product) which combines great hardness with an amorphous structure. Boron is, however, inferior to diamond of good quality in its strength. It rubs off rather readily on the diamond lap and even on the carborundum wheel. I do not consider it improbable that in further continuation of the work additional toughness may be imparted to boron and the product become a cheap substitute for black diamond.

I have not determined the melting point accurately but I judge it to be between 2000° and 2500°C, nearer the second figure than the first.

Boron is a rather volatile element, its vapor tension being already appreciable at 1200°C. It can, however, be fused readily not only under atmospheric pressure but also in vacuum.

The properties so far mentioned are in rather good accord with the position of the element in the periodic system. Boron has its place to the left of carbon and has so to say a right to be hard, conchoidal in its fracture—both properties of fused carbon—,to have a relatively high melting point and a vapor ten-

*Paper read before the American Chemical Society (Northeastern Section), Boston, Mass., Feb. 17, 1911.

sion of such magnitude that it volatilizes to a considerable extent while melting in vacuum.

In fact this similarity of properties might be used to determine in its turn properties of carbon. Thus the high vapor tension of boron would make it probable that the volatilization of carbon at high temperatures (as in incandescent lamps) is a thermal process and not due primarily to electric discharges or chemical processes. The search for a form of carbon having a low vapor tension comparable with that of metals such as tungsten would, in the light of this, be futile and I admit that the argument is weighty enough with me to have caused me to singularly reduce my efforts in that direction.

We come now to a property of boron which is entirely unexpected and places boron in a position all by itself. I refer to its electrical characteristics. When cold, boron is a very poor conductor. In this it still shows its similarity to amorphous carbon which is a very poor conductor and to diamond which is an insulator. But where it differs *is in the abnormal value of its temperature coefficient of resistance.* The resistance of boron very rapidly drops as the temperature rises.

The *resistance drops geometrically with arithmetic increase of temperature.* The law is, however, only approximate. If extended over large temperature intervals the interval corresponding to equal resistance ratios increases with the temperature. The relation between temperature and resistance was studied quantitatively up to red heat. When red heat is reached the resistance, however, still continues to drop rapidly.

This enormous influence of temperature on the resistance of boron combined with the fact that it occurs at ordinary temperatures makes the behavior as an electrical conductor entirely different from that of ordinary conductors. Thus Ohm's law becomes useless almost to the same extent as in case of gaseous media. In fact the behavior of boron is more like that of a spark gap or arc than that of a solid conductor. There exists, for instance, a "break down" voltage in case of boron as in that of an air gap. Below the break down voltage only very small current flows through a boron conductor but once current is started (the air gap is "bridged" over) boron becomes a relatively good conductor.

The potential drop across a boron conductor falls first very rapidly as the current increases but has a tendency to become constant and is usually approximately constant through quite a range of current. This potential current is again very much like that of a discharge through gases.

Speculation as to the cause of this abnormal behavior of boron might be of interest but I would like to emphasize only the following point, namely, that the enormous drop in resistance here takes place in an elementary substance, the conductivity of which is wholly metallic. Whatever theory may be proposed for the explanation of the behavior of boron this fact must be taken as fundamental

In fact the abnormal value of the temperature coefficient(as well as the high specific resistance) are peculiarly properties of *pure boron.* When foreign elements are added to boron the conductivity increases (in analogy to ordinary solutions) and the temperature coefficient of resistance becomes reduced in value until with a sufficiently large percentage of the foreign element the characteristic properties are entirely obliterated.

I will now give a brief description of the methods used in the preparation of the element.

We are using two different methods. In the first we start with the reduction of boric anhydride by magnesium. This reaction was carried out by various chemists beginning with Berzelius, Wohler, etc., and recently by Moissan. I must refer for a description of the results obtained by myself to my article in the Transactions of the American Electrochemical Society, Volume 16, 1909. It will suffice here to state that as a result of a thorough study of the reaction we made one step in advance of the previous workers—we found, that under certain conditions of temperature, proportion of reacting substances, etc., a perfectly homogeneous product is obtained which contains as chemical constituents only boron and oxygen. We called the substance "boron suboxide" without, however, desiring thereby to express a definite opinion as to its chemical nature. At the time this seemed to be an important improvement as the elimination of magnesium from the final product seemed to be desirable. Further work has shown, however, that in the treatment to which the impure product has to be subjected in order to obtain pure boron it matters little whether the impurity is oxygen or magnesium or nitrogen, etc. This treatment consists in heating up the impure boron whether containing boron suboxide or magnesium boride or nitride to a temperature near

the melting point of boron. At this temperature all these compounds dissociate, magnesium and nitrogen come off as such, oxygen as boric anhydride.

The preparation of boron suboxide free from other impurities proved, however, useful in connection with the solution of the problem of producing sound copper castings for the description of which the reader may be referred to the Transactions of the American Electrochemical Society, Vol. 18, 1910.

The main difficulty encountered in the development of this method was that of obtaining on a large scale high temperatures in the neighborhood of 2000° without the use of carbon in any form whatever as boron has a great affinity for carbon and carbonaceous gases at that temperature.

The second method is based on the decomposition of boron chloride by hydrogen at good red heat. This reaction is carried out in two different ways: (1) in an arc discharge taking place between two boron or water cooled copper electrodes in an atmosphere of boron chloride and hydrogen and (2) by deposition on a hot graphite tube heated by current passing through it. The temperature and conditions can be so adjusted that practically no combination takes place between the boron and the graphite and very pure boron can be obtained. Boron chloride is best prepared by passing chlorine over boron carbide which latter can be made in the electric furnace from boric anhydride and carbon.

I want to add a few words on the possible applications of boron in science and industry.

The first thing that suggests itself is its use for accurate measurement of temperatures. In view of the exceeding accuracy of electrical measurements and the rapid change of resistance of boron with the temperature an accuracy in temperature measurements could be obtained which would be greater than anything yet available, especially as the boron resistor could be introduced in form of a very small filament thus disturbing but very little the thermal conditions. Of course the boron thermometer would have to be calibrated and above red heat it would have to be enclosed in an envelope filled with inert gas.

Closely connected with this would be the use of boron as a temperature regulator in a way so obvious as to require no particular description.

The industrial applications, however, are those which have first claim on my attention. Without going into details I may say that these are based on the electrical characteristics of boron and on its mechanical properties.

The large drop of resistance with the temperature which transforms boron under certain conditions from a very poor conductor for normal voltages into a good conductor for abnormally high voltages is certain to make it valuable for protection of electrical currents.

The potential current curve which shows a drop in potential with increase in current makes possible the use of boron either alone or in connection with an ordinary resistance (so as to give a unit with a constant potential drop) for the purpose of regulating electrical machinery.

The influence of small amounts of other elements (carbon especially) on the specific resistance and temperature coefficient of boron, which was described above gives a very delicate means for adjusting the boron resistor to any prescribed requirements.

The valuable mechanical property of boron consists, of course, in the fact that it combines hardness with amorphous structure and in the course of our work we have already succeeded in producing meter jewels superior in quality to sapphire.

Will it be possible to approach the properties of diamond or perhaps by combining boron and carbon even exceed diamond in its hardness? I can only say that we are working on this problem.

In conclusion I wish to attract your attention to the close interrelation of electrical and chemical methods in the work I have tried briefly to describe to you to-night. The investigation was started originally for the purpose of determining whether boron is a suitable element for incandescent lamp filaments.. In the course of the investigation in order to isolate the element electrical methods had to be used to obtain the high temperatures needed. In fact the isolation of the pure element is practically impossible without the use of electrical methods and the failure of previous chemists can easily be explained by the fact that they did not possess the necessary electrical tools. Finally after the chemical problem had been solved and the element isolated its main applications have been found again in electrical machinery.

It is possible to deposit platinum by electrodeposition in as coherent a coating as any other metal.

"Lost Art" of Tempering Copper.

That the famous "lost art" of tempering copper, said to have been possessed by the Aztecs, Toltecs and Tarascans in prehistoric days in this country, never existed is the claim of several archaeologists and ethnologists of Mexico City.

Experiments made during the past week show that none of the many copper tools found in the ruined cities and in the graves of these dead tribes ever were tempered. Copper axes and knife blades found at Atcapotzalco were discovered to be so soft that they could be cut with a common pocketknife. On the other hand, Tarascan copper cutting implements from the Balsas River ruins in Guerrero were so hard that they would turn the edge of a modern knife.

Comparative analyses carefully made showed that the blades from Atcapotzalco were of precisely the same composition as the copper found in the ore of the nearby hills. Similar treatment showed that the hard, apparently tempered blades from Guerrero were of precisely the same composition as the copper in the ore from their hills.

Then comparison of the two classes of ore was made, also by analysis, and it was shown that the natural ore of the local hills was pure and soft, while that from Guerrero had been alloyed by nature with nickel and cobalt, making it almost as hard as steel in its natural condition.

Then across the minds of the scientists flashed the answer to the alleged copper tempering of the Mexican aborigines. In some sections of Mexico the copper was already tempered for them; the cobalt and the nickel fused with the copper when heated in their primitive furnaces, and the result was a grade of alloy which, when heated and sharpened, gave an edge which would cut like steel. The Indians knew nothing of the art of tempering the metal themselves, and could not have removed the cobalt and the nickel from their ores, even had they so desired.

On the other hand, in other parts of Mexico where the copper occurred practically pure, the implements made from it were soft and remain so to this day, proving decisively that the primitive Tubal Cains knew not what ingredients to put into their axes and knives to make them hard. The hard axe and knife would be, of course, infinitely superior to the soft, and it is impossible of belief that the Indians who built Mitla and Palenque and the other wonderful cities of America's Egypt did not know this, and would not have hardened their weapons to a razor's capacity for sharpness had they been able so to do.—*Mexican Herald.*

High Prices of Fusel-Oil and Amyl-Acetate Used in Lacquer Manufacture.

By W. A. Jones.*

As you are aware, there has been a great deal of talk about the high prices of amyacetate and fusel-oil being due to speculation. The quotation, the last week in April on both these materials was $2.30 to $2.40 per gallon with practically none offered. We doubt that the high prices are caused by speculation, not only from our intimacy with the different sources, but also from the fact that it is impossible to buy any appreciable quantity of crude oil for prompt delivery. If speculators were holding fusel-oil for high prices certainly they would sell it at the present figures. The oil which is now being offered is almost invariably for delivery between next July and December. This in itself is sufficient proof that present high prices are due to consumption running ahead of the supply. However, the oil now being bought will not be received in this country before the first of next Fall, and this is also an indication that present high prices will be maintained for some months to come, unless there is a very bad break in the market.

Unfortunately, the lacquer trade has to stand the main portion of the constantly increasing prices. Many lines which used amyl-acetate and fusel-oil as a solvent ten years ago, to-day use none, as they are able to use cheaper solvents. However, in the case of a metal lacquer the requirements are most severe, as a solvent must be used which is free from acid—will not absorb water and evaporate at about 135 to 150 degrees. Any solvent which fails in any of these three particulars will not make a lacuqer that can be used with satisfaction, under the present method of lacquering.

As an illustration, we would say that if the artificial leather trade to-day used the same

*General Manager, Celluloid Zapon Co.

percentage of amyl-acetate that they did ten years ago there would hardly be enough amyl-acetate for the artificial leather trade alone, leaving out all other uses. Such lines of manufacture have been compelled, one after the other to drop the use of this high priced solvent, as the physical properties mentioned are not so necessary, and by governing the temperature, humidity, etc., they are able to use other and cheaper solvents.

Some people have an idea that the number of solvents for celluloid are limited. The number is very large indeed, but in the matter of boiling point alone there is not one which boils at the right temperature or dries down properly, except amyl-acetate.

The lacquer manufacturers have, so far, stood practically all of the increased cost. Already the metal manufacturers are more or less disturbed on account of the increased prices. There is very little prospect of a change in the situation however, unless a break comes, but the lacquer manufacturer will not be able to stand the loss much longer, and the jump in the selling price on lacquer when it does come will be considerable. You can appreciate this when you recall that 18 months ago amyl-acetate was selling for $1.25 and to-day it is $2.30 to $2.40. The advance in lacquer will *not* be a few cents per gallon.

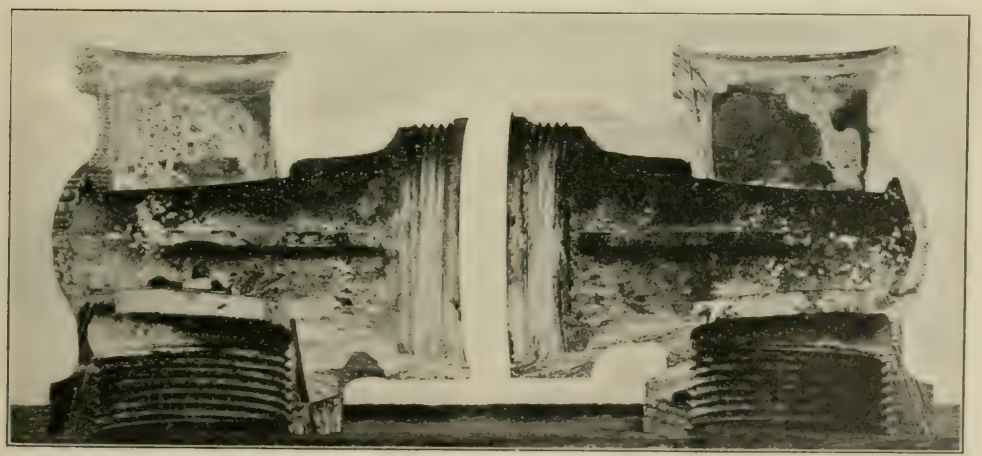
Danger of Imperfect Rinsing After Plating.

Next to the imperfect cleaning of work previous to plating, it may be said that the imperfect rinsing of work *after* plating is the most serious error found in modern electroplating practice It is so frequently found and often appears so perplexing upon first sight that comment on the subject is opportune. It is a condition very often encountered in plating establishments and is responsible for many poor results and much dissatisfaction.

When work has been electroplated, and the operation has been finished, the surface is covered with a film of the plating solution and if there are any pockets or holes in the article, these contain more or less of it. Now if the articles were dried without rinsing, the plating solution would evaporate and leave a coating of the plating salts on the surface. In order to remove the film of plating solution on the surface and that in the pockets or holes, the articles must be rinsed in water.

The practice that should be followed in rinsing work after plating is as follows:

1. After the work is taken from the plating solution, rinse in clean, *cold*, running water. Cold water will always dissolve the plating solution on the surface. Hot water should not be used for the first rinsing, for the reason



Nickel Plated Valve Cut in Half Showing Dried Plating Solution Inside from Insufficient Rinsing.

Hot pickling solutions for all metals are much more advantageous than cold ones and wherever possible should be used. They work more rapidly and more thoroughly than when cold.

that it is rare that it is had in the running condition, and because it leaves the work hot so that in case it is not clean, a film of the plating salt immediately dries on the surface. Swill the work well in this cold, running

water until *all* the plating solution has been removed. It is the function of this clean, cold water to remove it. Unless it is done, the hot water next used will become contaminated. It is in the use of the cold water for the first rinsing that the difficulty occurs. It is absolutely essential that this water be clean and that the work be left in it long enough to remove all of the plating solution on it.

2. After the work has been thoroughly rinsed in the cold, running water in order to remove all of the plating solution on it, rinse in hot water that is perfectly clean. This need not necessarily be running, although it is quite advantageous to have it so. The work is allowed to remain in this water for a few seconds until heated and it is then taken out and dried, either by swinging, shaking or immersing in sawdust. Many classes of work may be dried by allowing them to remain in the air. The heat of the metal dries the water from the surface. Others may be dried by swinging and some are best dried in sawdust. When dried in sawdust, the surface is less apt to be stained.

The whole danger in rinsing is in not using clean water. If the first or cold rinse water is not clean, then some of it is carried over to the hot rinse tank, and when the article is removed from it for the final drying, the water evaporating on the surface leaves a film of the plating salts. It is absolutely essential that both the cold and the hot waters shall be clean, and if especial care is not taken with the cold water, the hot rinse water will soon become contaminated and finally become more so. It is not infrequent to find plated goods upon which a dried film of plating salts can easily be detected, and is caused by the use of rinse water contaminated with the plating solution.

In the illustration is shown a case of imperfect rinsing. The article is a valve that had been nickel plated. When finished the inside was found coated with a white deposit which may be seen in the photograph of the valve cut in half. This was supposed to be a mysterious condition not previously encountered. The whole difficulty was in the use of rinse water that had become contaminated with the nickel plating salts. When dried, the salts evaporated and left the incrustation as shown. The outside did not show it for the reason that it was dried in sawdust and this served to remove it. The interior of the valve acted as a pocket to hold the solution, and was not removed in rinsing, but it remained inside and finally evaporated leaving the deposit as shown. The use of clean rinse water solved the problem.

In conclusion it may be said that the solution of the whole situation is to have the rinse waters, both hot and cold, clean. It is a simple thing and one apparently so unimportant that it is overlooked in many instances.

What Constitutes a Trace?

In reporting the results of a chemical analysis it is customary to designate exceedingly small amounts of any substance by a "trace". It is frequently perplexing to those who receive a report of an analysis to find traces of substances given and they often wish to know how much a trace actually is.

Strictly speaking a trace, in chemical analysis, is an amount too small to determine. It may be said, however, that it is a quantity too small to determine in the ordinary way as it is possible, by taking a large quantity for the analysis, and carrying on the highest refinement in the work, actually to weigh a trace, but in ordinary work it is not done, nor is it usually necessary.

In ordinary commercial chemical analysis, it is customary to carry out the percentages of the various ingredients to one-hundredth of one per cent (0.01%) and further than this, except in exceptional cases, it is deemed unnecessary. A substance present in this quantity is very small and is generally considered about the limit of practical analytical determination. Less than this 0.01%, therefore, is usually too small to determine and is called a trace.

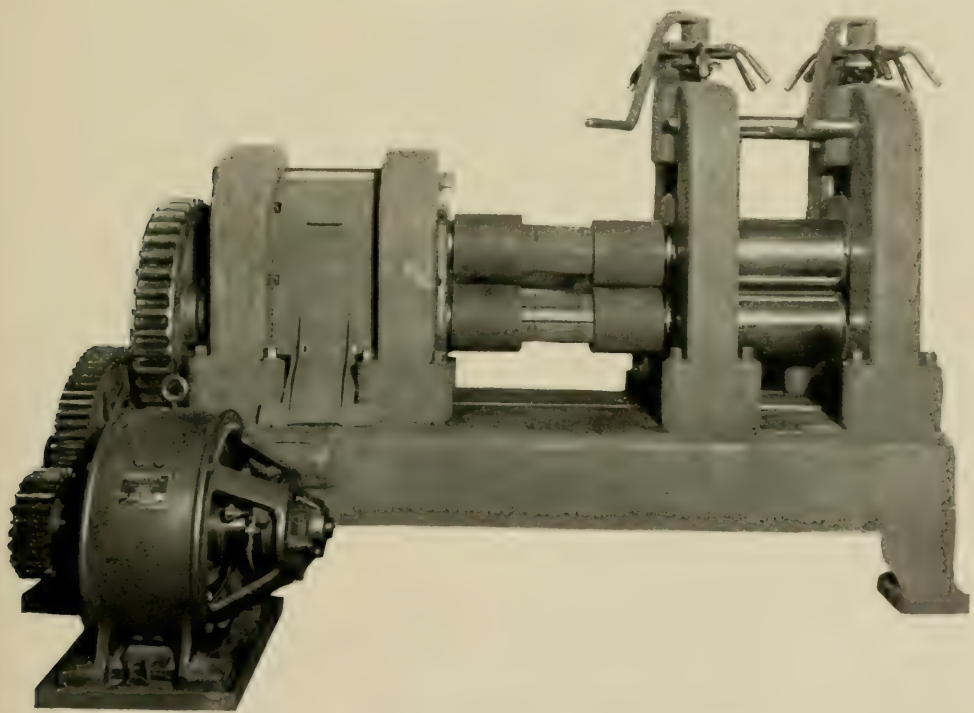
A trace, accordingly, may be called an amount of an ingredient which is present in the substance analyzed, but is too small to admit of quantitative determination. It is supposed to be less than 0.01%.

The use of the "salt-water" gilding process is now quite extensive and is capable of giving excellent results. It owes its advantage to the fact that the conditions are always absolutely uniform and the electrodeposition of the gold is independent of variations in current such as those experienced in using a dynamo as the source of the electric current.

A New Rolling Mill for Cold Rolling all Metals.

A new rolling mill for the cold rolling all kinds of metals has just been placed on the market by the Standard Machinery Co., of Providence, R. I. It is an extension of the regular line made by the company and which now comprises sixteen different sizes. It is used extensively with specially formed rolls for the rolling of extra large sections of copper mouldings, automobile rings, and for the rolling of sheet metal, sheet copper, zinc, German silver, nickel, platinum, gold plate and gold. It is also useful for breaking down ingots of precious metals to a thickness of about one-eighth of an inch, from which they are transferred to the finishing or mirror-lap rolls. Instead of solid steel, rolls may be made of the shell type, by forcing the steel over the hardened arbor.

phosphor-bronze bearings on rolled journals, with crucible steel adjusting screws. The upper boxes are supported by side yokes, which straddle the adjusting screws, and which are connected to the boxes by straight rods for lifting purposes. On the top of each upper box is a hardened and ground tool-steel thrust washer to take the thrust of the screw. The outboard of the roll housing is set on the bed with "T" bolts and "T" slots in the bed, allowing the use of different lengths of rolls by the sliding of the housings. The maximum length of roll that can be used is 22-inch, and the minimum length is 10-inch, with 12-inch diameter. The rolls are driven by cast steel wabbler couplings, directly connected to the herringbone pinion shafts in the gear housings. The roll ends are threaded, allowing them to be used with a water cooling attachment when desired. The method of forcing water through is accomplished by



New Rolling Mill of the Standard Machinery Company of Providence, R. I.

The accompanying illustration shows the machine with regular square section roll housings, fitted with rolls twelve inches in diameter and twenty inches face; heavy

special chambers made on the inner side of the roll. The chilled iron roll is cast with two ports, allowing the water to be forced into one port a certain distance and to return

through the other, thus keeping continual circulation. On the hardened steel roll, it is necessary to make a roll of this type with a shell on the outside, taking care of the water chambers by constructing arbors on which the shell or body is forced, with a special provision for the return water.

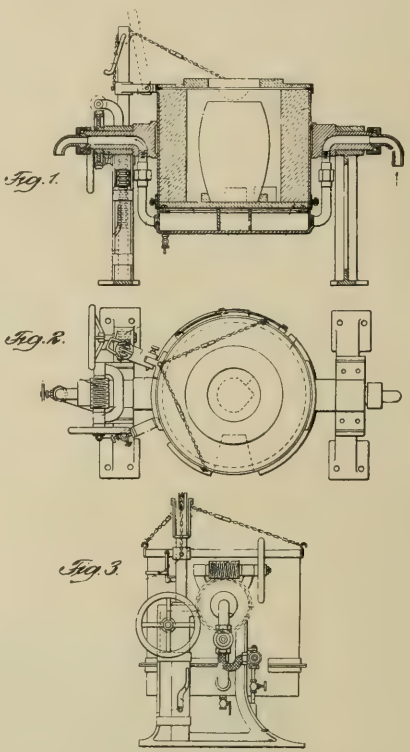
The advantage of having herringbone pinion gears made accurately and with cut teeth is important, as it provides for the uniform rolling of the stock, preventing any wrinkles, waves, or other imperfections, caused by uneven speed or by jumping on the roll surface. The herringbone pinion compensates for any back lash in the gearing, strains, or motor troubles.

This machine is driven by 50 H. P. direct current motor, at a speed of 1,000 R. P. M. The motor sets on a bed plate and is controlled by variable speed devices, allowing the use of different speeds while rolling. The total ratio of gearing, including all gears from the motor drive to the rolls, is 84 to 1. The machine is fitted throughout with friction clutch drive, direct gear drive, or chain drive. The total weight of the machine, including bed plate with motor, is 27,500 pounds. It occupies a floor space of 15 feet by 8 feet, and its over all height is 8 feet, 6 inches.

New Form of Tilting Crucible Furnace.

A new form of tilting crucible furnace has been patented by Wilhelm Buess of Hanover, Germany (U. S. Patent 987,793, Mar. 28), The furnace is herewith illustrated. Gas or oil is used for the fuel. The crucible rests upon the bottom of the furnace. The furnace itself has a casing or shell having openings through the side for admission of the flame which impinges upon the crucible and heats it.

The bottom of the furnace is made in such a manner that it may be readily detached for removing any metal or slag which may have lodged in it. The casing, top and base form a heating chamber and within it is the crucible. To reduce as far as possible the destructive influence of the flames on the bottom of the heating chamber, an air cooling chamber is provided on the lower surface of the bottom and connected to the iron plate constituting the base. Compressed air is employed as the cooling agent and this is passed in as shown. It is so constructed that at whatever the angle of the furnace the supply of cooling air is maintained. The heated



Sketch Showing German Tilting Crucible Furnace.

air from the bottom is used for supplying the fuel nozzles. The furnace is tilted by a worm gear.

The so-called pyrophoric or self-igniting alloys which emit sparks when struck by a hard substance, are composed of a cerium and iron alloy.

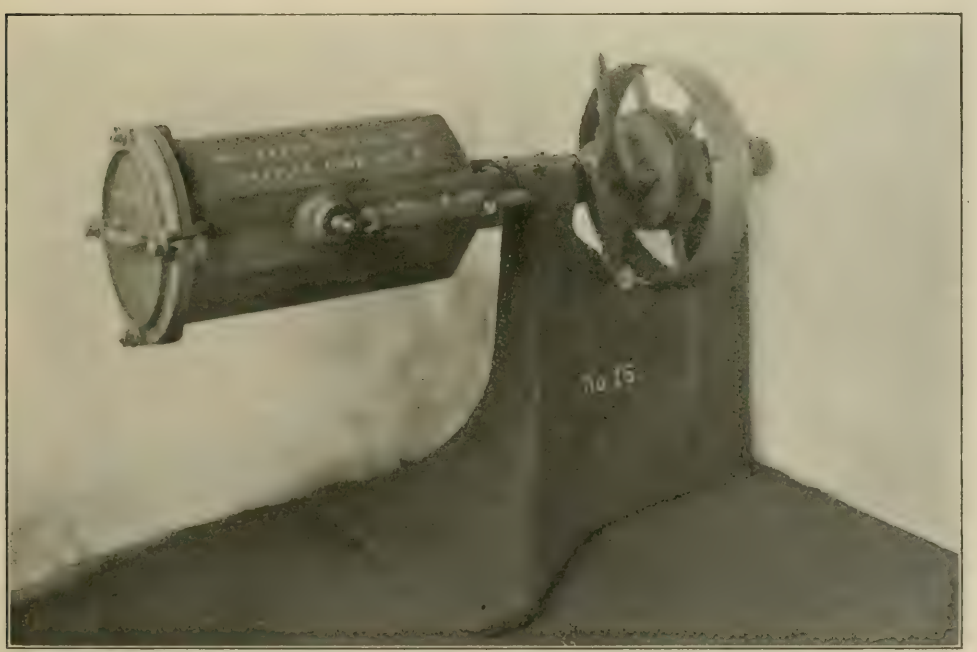
Molds for casting brass for rolling are preferably made of a soft cast-iron. It has been found to answer much better than a hard iron, as it does not crack as readily when heated by the metal.

Nitrates or nitric acid are very injurious substances in a nickel plating solution as they give a dark deposit. This was one of the early difficulties in nickel plating and was finally overcome by making the nickel salts by dissolving the oxide in sulphuric acid.

The New "Baird" Single Ball-Burnishing Barrel.

In order to take care of small concerns which wish to do steel ball burnishing by means of the tumbling process, the Baird Machine Company of Oakville, Conn., have recently designed and constructed a new single barrel for such work. The barrel is herewith illustrated.

It is intended, of course, for the burnishing of small metal goods by tumbling them with steel balls. Steel ball tumbling is now extensively used and by it, it is possible to produce a polished surface on brass, bronze, steel, German-silver and similar metal goods.



The "Baird" Single Ball-Burnishing Barrel.

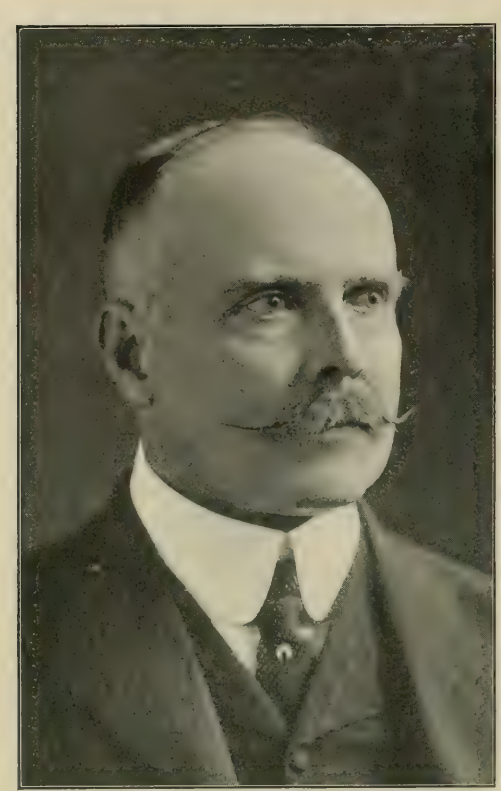
The single barrel has all the desirable features of the double barrel previously made by this company. It has friction clutch drive, tilting device, brass cover and is wood lined so that the work will not be abraded. The barrel may be belted direct to the main shaft or at right angles to it. It is made in two sizes: No. 1 is 10½ in. in diameter and 24 inch barrel inside; while No. 2 is 16 in. in diameter and 30 inches inside.

When nickel solutions foam it indicates that too strong a current is used and that there is an excess of acid. The foaming is caused by the evolution of hydrogen gas from the work.

"Burnt" nickel is the form produced in nickel plating when too high current density is used. It begins to show upon the edges of the articles being plated at first and is almost black. It is a hydride of nickel. Under such conditions, when the "burnt" nickel forms, hydrogen gas is usually given off more or less freely from the articles.

For small brass work to be given a matt or dead surface, the dead dip is preferable as a number of pieces may be done at once. For large work, the sand-blast is preferable and is extensively used. The sand-blast may be used on small work with equal results, of course; but each piece must be handled separately which renders it more expensive than the matt dip.

Progress in "Coslettizing."



Thomas Watts Coslett, Inventor of the "Coslettizing" Process.

The treatment of iron or steel goods by the "Coslettizing" process in order to render them rust proof, and at the same time give them a dead black color, has now become a standard process and many large concerns have taken out rights. This process is the invention of Thomas Watts Coslett of Birmingham, England, and is carried on by the Coslett Anti-Rust Syndicate Ltd., of that city. A. E. Flavell, 151 West 47th. St., New York City is now representing the company in the United States and is engaged in installing plants in this country.

The "Coslettizing" process consists in boiling the iron or steel article in a solution of phosphate of iron containing phosphoric acid. A dead black and rust proof finish is produced. The great advantage of the finish lies in the fact that it can be applied to all classes of tempered steel goods, no matter how thin or delicate. In Fig. 2 is shown some thin steel articles treated by the process and indicating its application to ornamental work.

Extensive uses are now made of the finish in England, and in the United States, where the process has only recently been introduced,

Articles Showing the Application of "Coslettizing" to Ornamental Work.

typewriter, electrical and saddlery hardware concerns are now using it with good success. The application of the process is very extensive as it requires but little and inexpensive equipment and can be quickly applied to large or small work with very small expense.

Dr. Dudley's Phosphor-Bronze Containing 0.8% of Phosphorus.

No specification for a non-ferrous alloy has ever created as much discussion as the so-called "Pennsylvania R. R. Phosphor-Bronze' the formula for which was evolved by the late Dr. C. B. Dudley, chemist for the railroad The formula was his own invention and was made public many years ago by the issuing of specifications for it by the railroad, The alloy is used for bearings, and coming from such a distinguished man and such a large railroad, more than ordinary interest was taken in it. The interest displayed was created by the fact that 0.80% of phosphorus was called for in the specifications.

That 0.80% of phosphorus in phosphor-bronze is altogether too much has now been thoroughly demonstrated. In justice to Dr. Dudley it should be stated that at the time the specification was issued, the knowledge of phosphor-bronze was very meagre, and from the literature that had appeared on the subject previously, it was assumed that a high phosphorus content was required. This has since been proved erroneous and that a low content is actually required.

It was assumed by Dr. Dudley that a large amount of phosphorus was required on account of the fact that in a railroad brass foundry the metal is melted over and over again in the form of worn car brasses returned. It was believed that the phosphorus would burn out quite rapidly when the metal is melted, but this idea has also been exploded. As a matter of fact very little phosphorus burns out in the melting.

The 0.80% phosphorus content was arrived at from the fact that in making the phosphor-bronze, about 20% of the phosphorus wastes, so that 1% was added to the bronze and a 0.80% content was supposed to be present in the resulting alloy.

Since the aforesaid specification for phosphor-bronze was issued, it has been found that such a high phosphorus content as 0.80% causes the liquation and segregation of the tin with the formation of hard tin-spots on the bearing surface which tend to cut and heat the axle or shaft running in it. The phosphorus should be 0.25% or under in order to guard against these spots, and the best phosphor-bronze is that which contains much less an amount. From 0.05% to 0.10% has been found to give excellent results.

To Dr. Dudley belongs much credit for having brought the purchase of bearing metals up to a standard. Before that time there were simply two kinds of metal: Yellow and red. What one did not satisfy the other did. Although the high phosphorus content was afterwards found excessive, he was fully justified in drawing up his specifications as he did when the meagre knowledge of alloys at that time is taken into consideration.

Electroplating Problems.

At a meeting of the Sheffield Electro-Metallurgical Society on April 7, four members contributed short papers under the title of "A Symposium of Workshop Problems." Mr. A. Jefferson urged the importance of preparing non-ferrous metals for electroplating, pointing out that the plater could not hope to have a perfect deposit unless attention was given to this matter. He thought that electricity might eventually be used as a means of preparing the surfaces of articles for the vat. Mr. Frank Mason expressed the view that if a perfect base metal were supplied 75 per cent. of the troubles of the plater would disappear. He believed "pitting" to be due to the metal. Mr. C. Puttrell dealt with the difficulty of "frosty patches" on plated britannia metal, and complained of the action of manufacturers who marketed goods made from metal which was very little removed from lead, and marked them "B. P." Mr. Barclay suggested that manufacturers of Britannia metal should conduct experiments upon the deoxidising of metal. In a paper dealing with the lack of uniformity in the results of electroplating steel blades, Mr. Hodkin advocated the manufacture of a special quality of steel which would be suitable for the purpose. With regard to this point, Professor Arnold (who presided) said that sulphide of manganese was an important factor, and there was a greater proportion of this in common steels than in the best.—*The Ironmonger.*

Questions and Answers.

QUESTION No. 969. What is the trouble with my cyanide copper solution? It gives off gas quite freely from the work that is being plated, but I can get no deposit. The anodes remain very bright and it seems as if the copper might be depositing on it, but I found that I did not have a wrong connection.

Answer. You have too much free cyanide in the solution. The fact that there is no deposit on your work and that the anodes remain very clean indicates it. Add carbonate of copper to the solution until you get a deposit as this will take up the excess of free cyanide which you have.

QUESTION No. 968. We make a small box of sheet aluminum and consisting of two parts, the top and the bottom. Both are made of drawn sheet aluminum. We are putting a satin-finish on these boxes by the use of the potash dip, but find that while we are able to get it on some of the goods, others have a mottled appearance. The appearance of the box is spoiled as the top and bottom do not look the same. What is the cause of the different appearance of the aluminum after it has been dipped? Is the sheet aluminum of varying quality?

Answer. The cause of the spotted or mottled finish on your aluminum is that you have not given it the same treatment as the others that have the desired dead surface. Try two pieces at the same time in the dip so that they will receive equal time in the immersion and you will find that they will be the same. The sheet aluminum is almost invariably of uniform quality, and when hot, the difference is in streaks in the metal.

QUESTION No. 971. We are nickel plating malleable iron castings and when finished the nickel does not look bright and clean. This refers to the work after it has been plated. We do not buff the work. If we do, it has a good appearance. What causes the dark, dead color?

Answer. The trouble is that you have not rinsed your castings in clean water after they have been plated. Rinse first in clean, cold, running water, after the castings have been nickel plated, and then in hot water that is also clean. Your hot water is probably dirty so that when it evaporates on the surface in drying, a dirty film of foreign matter is left. This is a very common error in plating. The remedy is very simple—have clean rinse water.

QUESTION No. 972. What is the effect of aluminum on compositon or bronze used for making valves or plumbers' goods? We find that while aluminum is extensively used in yellow brass, it is not used at all in the red metals. We think one would naturally say that if it is good for one, it ought to be good for the other.

Answer. The difficulty with the use of aluminum in red metals used for valves and other goods to stand pressure is that it causes them to leak when pressure is applied in testing them. This, of course, is a very serious objection. In castings of red metal which are not subjected to pressure, the aluminum does no harm, but also does no good. There is, therefore, no object in adding it. It is in yellow brass that aluminum is advantageous and is extensively employed. For yellow brass castings to stand presure, however, such as gas cocks, faucets etc., aluminum should not be added to them as it also causes them to leak.

QUESTION No. 973. We are contemplating the installation of plating tanks to hold acid copper solutions and they will be made of wood. Is there any particular lining used for an acid copper solution?

Answer. The same kind of lining is used for an acid copper solution that is employed for other solutions. You can use your tanks without lining, but it is always preferable to line them as they are then less apt to leak and last longer. Use asphaltum or pitch for lining the tanks and apply it hot.

QUESTION No. 974. In yellow brass for making an ordinary run of automobile work in which aluminum is used in a small quantity for making the castings sound, I wish to ask what is the objection in using a larger quantity of spelter than is commonly employed for this work. Say a mixture of 60 parts of copper and 40 parts of spelter. The average mixture is about 66 parts of copper and 34 parts of spelter. The 60 and 40 mixture would be cheaper and stronger.

Answer. The disadvantage of using the mixture you mention is that it will not have the desired yellow color. It has a reddish shade. In automobile work, a yellow color is desired on all the work so that it will match. With this exception, there is no objection.

QUESTION No. 975. What is the quantity of free cyanide used in a silver solution for plating flat ware? Also in making a bright silver solution are the same proportions of silver and free cyanide employed?

Answer. It is customary to use about 3 oz. of free cyanide to each gallon in a silver solution for plating flat ware. This varies with different platers but not to any great extent. About the same quantity of silver is used. When a bright solution is used, the silver is not changed, but the free cyanide is increased. Use from 4 to 5 oz. of free cyanide per gallon. It is necessary to have a little more free cyanide in a bright silver solution.

QUESTION No. 976. How can it be ascertained that ingot brass has been made from light brass? We do not find any iron in it when the castings are machined, but we feel sure that light brass has been used and we do not want to purchase ingot metal from a concern of this kind. While we have not found iron in pieces that have affected the tools, we are afraid we will and it will then be costly.

Answer. The amount of iron in the brass, as shown by analysis, tells the story. When

made from light brass, ingot metal will frequently show from 1.00 to 2.00 per cent of iron. An iron content of over 0.50% should be looked upon with suspicion, and when it rises to 1.00 per cent, it indicates that light brass (containing all kinds of iron and steel screws, rivets, wire, pins etc) has been employed in the making of the ingot.

QUESTION No. 977. What is the more satisfactory for automobile bearings, genuine babbitt-metal or white brass? There seems to be a difference of opinion in regard to the matter.

Answer. Both give satisfactory results as bearings and are extensively used. They have been found quite satisfactory for crank shaft bearings. As genuine babbitt-metal casts better and the castings are cleaner, it is preferable for small castings. When the castings are equal, however, there is nothing to indicate that one is preferable to the other. The white brass is a cheaper mixture, and is frequently employed in preference to genuine babbitt on this account.

QUESTION No. 978. I send you a gilt button shell and would like to know how the gold finish is produced. The letters are bright burnished while the background of the shell has been painted black. It occurred to me that possibly the shell may have been fire-gilded. The button was made in England.

Answer. The fact that the shell is not soft would indicate that the gilding was not done by the mercurial or fire process. This always softens the brass of which the shell is composed. The gilding was apparently done by electrodeposition. The object of painting the back was to prevent the deposition of the gold on it thus saving it. The shell was lathe burnished after gilding and the letters thus left as you have mentioned—in a burnished condition. The dead surface of the background was produced by the die in striking up the shell.

QUESTION No. 979. In our scrap metal business we accumulate a quantity of aluminum chips from castings. These chips contain from 2% to 4% of zinc and we would like to know if there is any method that we can use for removing the zinc from them. The zinc, of course, is in the aluminum and not as zinc turnings or chips. What we would like to do is to eliminate the zinc and make the aluminum in the so-called "No. 12 Alloy" which is, as you no doubt know, an alloy of aluminum and copper only. Is it possible to eliminate the zinc?

Answer. We do not know of any method of eliminating the zinc successfully. It can, of course, be "burned" out by heating the aluminum red hot for some time, but this injures the aluminum. It is not to be recommended. We have heard that sulphur can be used for this purpose, but have never found anyone who has actually used it. We suggest trying it, however, as it may be successful. The sulphur is to be used in small quantities at a time on the surface of the molten metal with stirring.

QUESTION No. 980. As a subscriber I would like to obtain information on a matter that has been very annoying to me. I have to plate steel hinges with both brass and nickel. Sometimes nickel is wanted and often a brass plate is desired. In plating these hinges black streaks show after the deposit has been put on. These streaks start from the hinge joint and go upwards. They are straight and seem to buff off to a certain extent, but we do not like to see them as it seems to indicate that there is something the matter.

Answer. The cause of the streaks coming from the hinge joint is that you have not washed out the polishing dirt that is left in there after polishing. This dirt gradually works out during plating and produces the streaks as shown. The remedy is to wash out the dirt before plating. This is done by soaking the hinge in whale-oil soap, fig-soap or similar soaps used for this purpose, after which the hinge can go through the regular alkali solution for cleaning off grease or oil and then to the plating bath.

QUESTION No. 981. In making fine brass castings, such as parts of gas and electric fixtures, art metal work etc., is it customary to pickle the castings in hydrofluoric acid to remove the sand which adheres to the furnace? The castings we are turning out are coated with sand that is burned on and we cannot get it off by dips or sulphuric acid pickle.

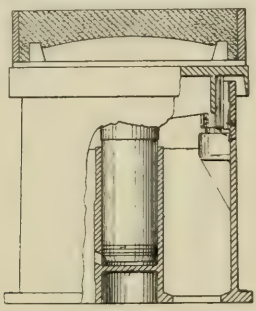
Answer. You will have to use hydrofluoric acid to remove the sand. You should not have such poor castings, however, and it is not customary in the trade which manufactures such fine castings to pickle them as it is not necessary. When properly made, these castings will require no pickling. Either your sand is not suitable for the purpose, or the metal is not good. The castings should come from the sand almost clean. It is customary to dip such castings, however, as this cleans the surface and allows them to be inspected for imperfections. To make the finest castings with the best surface, the metal must be good and the face of the mold skin-dried. If you also smoke the face of the mold the castings will come much cleaner.

QUESTION No. 985. We wish to pickle some brass and composition castings in hydrofluoric acid to remove the sand that has burned on them. As we have never used the acid before wish to ask what we can put it in? We know that a stone crock cannot be used and presume that an iron tank would also be attacked.

Answer. You can use a wood tank if you wish and if you have a small quantity half a barrel will answer. The barrel, of course, should be tight. Dry it out and then give it a heavy coating of asphalt applied hot. The barrel can even be used without lining, but you will find it will last longer if lined with the asphalt. The best kind of tank, however, is a wood one lined with sheet lead with the joints burned together, but this is more expensive than the wood lined with asphalt. If you are to use the tank continuously, it will be more economical to line with lead.

Patent Abstracts.

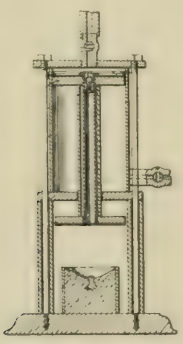
989,971, Apr. 18, 1911. MOLDING MACHINE. Charles Herman of Zelienople, Pa. Assignor to the Herman Pneumatic Machine Co. of Pittsburgh, Pa. The object of the invention, which relates to molding ma-



chines of the jarring type, is to provide such a machine with means for guiding the pattern plate in its movements, and at the same time to allow the cushioning of it during its striking in the jarring operation.

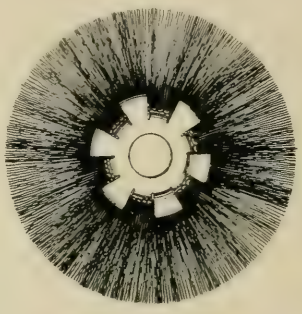
989,170, Apr. 11, 1911. MOLDING MACHINE. Alexander Mathiesen of Armley, near Leeds, England. A molding machine for making sand molds in which the sand is rolled into the mold, instead of rammed, by a series of small rollers which roll over the surface of the mold when the sand has been placed in it.

989,387, Apr. 11, 1911. CASTING MACHINE. Virgil H. Mills of Hubbard, Texas. The machine is for casting metals under pressure, particularly small quantities such as those used in the jewelry or dentistry trades. The metal is melted on the top of the mold,



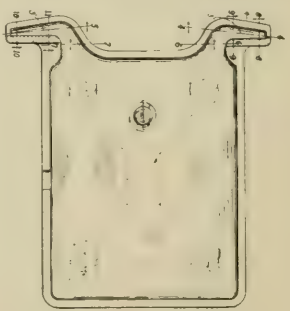
and then a plunger is forced down on it by compressed air so as to render it air tight, after which additional pressure releases a valve and places pressure upon the metal itself forcing it into the mold cavity.

988,506, Apr. 4, 1911. ROTARY BRUSH. Rudolf Radinse of Cleveland, Ohio. Assignor to the Manufacturers' Brush Co. of the same place. The brush is intended for foundry or



platers' use and the object of the invention is to furnish an improved means of holding the wires or bristles, of which the brush is composed, in place. Reference to the illustration will indicate the method of performing it.

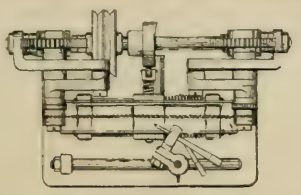
988,564, Apr. 4, 1911. ANODE MOLD. Ulysses A. Garred of Anaconda, Montana. The mold is intended for the casting of copper anodes for electrolytic refining. The features of the mold are allowing an anode



to be cast without fins or rough edges, special provision for ejecting the casting, dispensing with cooling or coping blocks, and giving an anode that may be suspended in the vat readily.

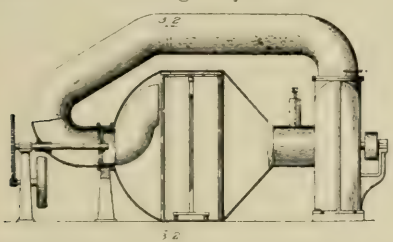
988,509, Apr. 4, 1911. PROCESS OF MANUFACTURING METALLIC MANGANESE AND ALUMINUM FLUORIDE. Walter S. Rockey and Hilliary Eldredge of New York City. A method of making metallic manganese and aluminum fluoride at the same time. Manganese fluoride is reduced by means of metallic aluminum at its melting temperature. Fluor-spar is used as a flux with the manganese fluoride.

988,553, Apr. 4, 1911. APPARATUS FOR SOLDERING CHAINLINKS. Richard Dollinger of Pforzheim, Germany. Assignor to the firm of Ernst Gideon Bek of the same place. A machine for the continuous soldering of chain links. The links are made of



wire with a core of solder. The invention relates more particularly to the method employed for vibrating the links as they are being soldered, so as to prevent adherence to one another.

988,978, Apr. 11, 1911. APPARATUS FOR COATING OBJECTS WITH SUBDIVIDED Metal. George L. Cragg of Chicago, Ill. Assignor to the Bradley & Vrooman Company of the same place. An apparatus for coating objects with bronze

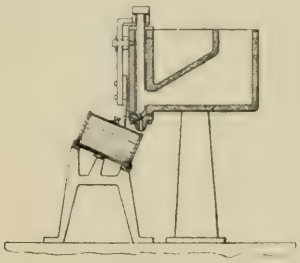


powder. The surface of the object is previously coated with a varnish of some kind that will cause the bronze powder to adhere. The bronze powder is carried by a blast of air to the surface. The invention relates to the method of applying the blast.

989,593, Apr. 18, 1911. MOLDING MACHINE. James J. Fitzsimmons of Baltimore, Md. Assignor to the Central Foundry Co. The molding machine is so constructed that the molds are completely made in one operation and by unskilled labor. The improvement is in the method of constructing the machine and it is operated by compressed air.

989,573, Apr. 18, 1911. SOLDER. Joseph N. Daudelin of St. Hyacinthe, Quebec, Canada. A solder to be used more particularly for aluminum. It is composed of the following: Silver, 22 grains; Phosphorus, 42 grains; Copper, 238 grains; Lead, 1338 grains; Tin, 5051 grains; Aluminum, 50 grains; and Zinc, 939 grains.

989,818, Apr. 18, 1911. DEVICE FOR APPLYING LIQUID SOLDER. Harry K. Smith of Federalsburg, Md., automatic device for applying solder to the seams of sheet



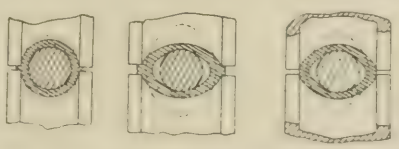
metal cans. A tank holds the molten solder and it is applied to the joint by means of nozzles as shown in the illustration. The supply of solder is controlled by valves.

989,291, Apr. 11, 1911. DEVICE FOR POLISHING CURVED SURFACES. James R. Richardson of Pittsburgh, Pa. A device for grinding and polishing rolls without taking them out of their housings.

989,568, Apr. 18, 1911. ELECTRIC FURNACE. Michael R. Conley of New York City. A resistance furnace for melting metals. The resistance material consists of a mixture of 60% clay and 40% carbon and the shape of the furnace is the real novelty. It is made so that the body portion is of low resistance, while the part in which the melting takes place is of high resistance.

989,815, Apr. 15, 1911. STEREOTYPE CASTING MOLD. Walter Scott of Plainfield, N. J. A method of casting stereotype metal and the feature lies in the manner of moving the drag of the mold towards and away from the cope.

988,834, Apr. 4, 1911. TUBE ROLLING Ralph C. Stiefel of Ellwood City, Pa. Assignor to the Shelby Steel Tube Company of Pittsburgh, Pa. The object of the invention is to effect the rolling out of a tubular blank



upon a mandrel in the most expeditious manner and to accomplish the entire reduction required of the blank by a few sets of rolls. Also to produce a tube of true circular shape which shall be delivered loose upon the mandrel bar.

Trade Items.

Plans and specifications are being prepared by Charles T. Main of Boston, Mass., mill engineer and architect, for the new seven story brass foundry of the Yale & Towne Mfg. Co., of Stamford.

Negotiations are under way for the purchase of the so-called "Burner Shop" of the Bristol Brass Co. at Forestville, Conn., by the International Silver Co., of Meriden, Conn. This company manufactures a line of silver plated wares at their Forestville plant.

The Rector Gas Lamp Co., 131 West 31st St., New York City, has purchased a factory in Scranton, Pa., and will equip it for the manufacture of the brass portions of its lamps. A new brick building, 80 x 100 feet will also be erected. Gas lamps are manufactured.

Joseph T. Ryerson & Son of Chicago, Ill., the well known iron and steel merchants, have taken the American agency for "Glyco Metal" which is a babbitt-metal extensively sold in England. It is the invention of John Edward Stead of Middlesbrough, England, the noted metallurgist. Joseph T. Ryerson & Son are to carry a complete stock of the metal at their various warehouses. It is made in several grades to suit requirements.

C. C. Griffin, 101 West Federal St., Youngstown, Ohio, has secured the interests of the late R. H. Marshall of Scottdale, Pa., in his patents for the elctrodeposition of a silver and nickel alloy. The process is intended for depositing this silver and nickel alloy upon goods usually silver plated. Coffin hardware, flat-ware and hollow-ware are examples of this kind and the use of the two metals produces a white deposit at a low cost.

The Hanson & Van Winkle Co., of Newark, N. J., and with branch offices in Chicago and New York City, manufacture an exceptionally complete line of polishing and buffing compositions. In tripoli, a number of different grades are manufactured to meet any requirement. Their "Old Style" (O. S. brand) is their best grade and is used by many concerns with such excellent results that the extra cost is waranted. In white polishing compositions a large assortment is made to meet any requirement or price. All grades and kinds of rouge and crocus compositions are made from the finest for gold and silver, to the most inexpensive kinds for cheaper metals. In special grades, black rouge is now preferred by many for silver and for use on horn, celluloid, and other similar substances. Emery paste and cake are made to suit every requirement. The Hanson & Van Winkle Co. have recently issued a new catalogue of their buffing and polishing compositions in which all grades are described, and is an extremely useful and instructive book. Every plater and polisher will find it valuable and it will be sent upon request.

A new stockroom, 40 x 86 feet, is to be erected by the Ball & Socket Co., of West Cheshire, Conn., manufacturer of buttons, and sheet metal and wire specialties.

Fretz, Gross & Co., 1015 Diamond St., Philadelphia, Pa., manufacturers of umbrella hardware, have acquired property at 26th St. and Sedgley Ave .in that city and will erect a new plant on it. A one story, concrete factory will be built. Umbrella tubing and hardware will be made.

The plant of the New Jersey Zinc Co., at South Bethlehem, Pa., has been shut down and will be abandoned. The employees of the plant have been transferred to the new works of the company at Palmerton, Pa. No decision has yet been reached about the disposal of the South Bethlehem plant and it has not been sold to the Bethlehem Steel Co., as reported.

The Divine Bros. Co., of Utica, N. Y., manufacturers of buff-wheels and polishing wheels of all kinds, have recently increased their capital stock in order to make enlargement of their plant. The stock has been increased from $50,000, to $100,000. The new mill will be a three story and basement structure 46 x 115 feet, and will front on Hotel St. About 120 hands are now employed, but it is expected that 200 will be needed when all the improvements have been made.

The Yale & Towne Mfg. Co., of Stamford, Conn., one of the largest manufacturers of builders' hardware in the United States, is to establish a plant for the manufacture of their products in St. Catherines, Ont. Canada. The ground for the plant has been obtained and it is hoped that the works can be completed by 1912. The same classes of goods manufactured in the United States will be made. A brass foundry and plating plant will be required. The companv have had the establishment of a Canadian plant under consideration for some time, and have only recently decided upon a location.

The Standard Rolling Mills, 363 Hudson Ave., Brooklyn, N. Y., are manufacturers of all grades of sheet britannia-metal and other white metals for stamping, spinning or drawing into ornamental goods. They also do casting, rolling and refining for the trade. They make all grades of metal, from the highest grade britannia metal to the most inexpensive kinds for the cheaper classes of work. They number among their customers many of the leading metal concerns in the United States and are always desirous of quoting prices or giving information to concerns who are consumers of sheet metals for the above purposes. A new product of the company is "Duplex Britannia Metal" which has many new uses. They solicit inquiries about it and will be pleased to supply all information upon request.

The International Silver Co. of Meriden, Conn., have been awarded the contracts for the silver-ware to be used in the new Hotel Taft in New Haven, Conn. The cost of the ware will be about $25,000.

The Wire Specialty Co., 549 Fulton St., Chicago, Ill., manufacturers of small wire goods and wire forming machinery, are to move their plant to South Bend, Ind., where larger quarters will be had and more extensive facilities for manufacturing.

Jeandheur Bros. of Newark, N. J., are now carrying on platinum plating for the trade. They announce that there is quite a trade in it upon jewelry work and it is believed that they are the only company now making a business of platinum plating for the jobbing trade.

The Fairview Foundry Co. of Detroit, Mich iron, brass and aluminum founders, have increased their capital stock from $100,000 to $200,000. A new site has been purchased in the Fox Creek district of Detroit and it is stated that a new plant will be erected on it. The company is affiliated with the Chalmers Motor Co. of Detroit, Mich., automobile manufacturers.

The Bristol Co., Waterbury, Conn., manufacturers of the "Bristol" Recording Instruments, have just issued a new Bulletin No. 147 A describing the Bristol-Durand Radii Averaging Instrument and its applications. This bulletin will be found valuable to those interested in recording instruments. The company are also sending out Bulletin No. 146 A, describing Bristol's Long Distance Recording Tachometer. This is used for recording the revolutions of shafting, engines, etc.

The Loeb Electrochemical Co., 467 Greenwich St., New York City, have purchased the assets, stock and fixtures of the bankrupt Levett Mfg. Co., of New York City, formerly manufacturers of plating and polishing equipment and supplies. The Levett Mfg. Co., recently purchased the business of the Zucker & Levett & Loeb Co., of New York City which went into bankruptcy, and afterwards became bankrupt themselves. Walter Loeb, of the Loeb Electrochemical Co., was formerly connected with the Zucker & Levett & Loeb Co.

The Hoyt Metal Co., 111 Broadway, New York, the well known producers of white metals, have, after years of experimenting, succeeded in producing a substitute for britannia-metal. This material is made of two kinds of metals. A cheap metal is used on one side and britannia-metal on the other. The whole is then rolled into sheet. This sheet metal can then be used for making stamped metal goods, such as brush and mirror backs, casket name plates and metal novelties at a cost for the metal of $300 less per ton than when ordinary britannia metal is used. Samples of this metal will be submitted to manufacturers and users of britannia metal should investigate this cheap substitute as it will save money for them.

The Irving Mfg. Co., has been organized at 35 Austin St., Newark, N. J., to manufacture 10K and 14K jewelry.

The machinery of the American Valve & Meter Co., of Cincinnati, Ohio is now being moved to the new plant on Spring Grove Ave. in that city and it is expected that the plant will be in operation in about 30 days.

The Finished Parts Mfg. Co., have incorporated their company and are now known as the Finished Parts Mfg. Co. Inc. The works of the company have also been moved from 68 Orchard St., Newark, N. J., to 359 Mulberry St., where larger quarters are had. The manufacture of die castings is carried on.

The J. W. Paxson Company, Philadelphia, Pa., manufacturers and dealers in foundry supplies and equipment, have recently placed on the market a new type of sand mixer and blender for molding sands which is operated upon the principle of the Chili mill, thus thoroughly mixing and blending the sand treated. Circulars will be sent upon request.

The Spirella Co. of Meadville, Pa., manufacturers of corsets and corset hardware and trimmings, are to move their plant to Niagara Falls, N. Y., where a site of four acres has been acquired on Whirlpool Ave. A new factory to cost $400,000 is to be built. A smaller plant will also be erected on the Canadian side. This company carries on an electroplating plant in connection with their business.

A new foundry is being constructed by the Standard Brass Casting Co. of Oakland, Cal. It is 100 x 100 feet and two stories high. Additional oil furnaces are being installed and which will give a capacity of 7,000 lbs. per heat. A five ton travelling crane is also being erected. The company will soon occupy the new foundry and additional equipment will be purchased from time to time.

The Lorain Metal Products Co. of Lorain, Ohio has been organized and has taken over the following companies: O'Brien's Brass Works, brass founders; the Stauder Foundry, iron founders; and B. R. Maddock's Pattern Shop. B. R. Maddock will be in charge, but no incorporation papers will be taken out at present. The office of the company are in Lorain Block, Lorain, Ohio.

The Tottenville Copper Co., Tottenville, N. Y., makes a specialty of producing alloys of copper, tin, lead and spelter in accordance with specifications. Their specialties are: Bronze Valve Metal for manufacturing valves and high grade steam metal parts. Yellow Ingot Metal for manufacturing high grade plumbers' brass goods. Manganese-Bronze Ingot made according to U. S. Navy Specifications and used by shipbuilders and automobile manufacturers. Phosphor-Bronze Ingot according to standard formula. Steam-Metal Composition Ingot for manufacturing ordinary red metal parts and steam specialties. Prices will be submitted upon application and other information gladly given upon request.

The Peerless Surface Machine Co., manufacturers of grinding and polishing machines, have moved to 222 Washington St., Newark, N. J.

The Philadelphia Coppersmithing Co., 119 Florist St., Philadelphia, Pa., have purchased property adjoining their plant, and will erect new works on it.

The Otto Higel Co. Ltd., of Toronto, Canada, manufacturers of automatic piano players, are to establish a plant in Buffalo, N. Y. Large quantities of aluminum are to be used in the manufacture of these players.

The Royal Silver Mfg. Co., has started in the manufacture of sterling-silver novelties and sterling-silver mesh bags at 46 Oliver St., Newark, N. J. W. T. Goldsmith is president of the company and R. Udell, secretary and treasurer.

The Kroenert Smelting & Refining Co., 6620 Kelly St., Pittsburgh, Pa., are now manufacturing solder, refined spelter and babbitt-metals under the personal supervision of Joseph J. McDermott, who has had over thirty years of exyerience in this line of work.

The Manville Bros. Co., 25-33 Benedict St., Waterbury, Conn., manufacturers wire and metal working machinery, have just issued a new catalogue of foot presses describing the various types of goods which they manufacture. This catalogue will be sent to those desiring it.

S. Sternau & Co., 195 Plymouth St., Brooklyn, N. Y., manufacturers of hollow-ware such as chafing dishes, alcohol lamps and household novelties, are to build a new plant and have already awarded the contract for it. The new building will be 10 stories high, 85 x 122 feet and of concrete.

The Los Angeles Brass Works and the Liebfried Brass Mfg. Co., both of Los Angeles, Cal., have consolidated under the name of the Los Angeles Brass Mfg. Co., with a capital stock of $25,000. The plant is located at 711 North Main St. The plant uses oil for fuel and has a daily melting capacity of 3,000 lbs.

The Pittsburgh Testing Laboratory of Pittsburgh, Pa., established in 1881, have moved to their new building at the corner of 7th and Bedford Aves. in that city. Better facilities and larger quarters are now had for carrying on their work. The laboratories are fitted up for prompt service and the latest machinery and devices for performing chemical work have been installed.

The General Bakelite Co., 100 William St., New York City, issue a catalogue and complete description of their various products and which gives some very interesting information about their goods. Bakelite is a new product and the catalogue tells all about it. It will be found well worth perusal, and as bakelite is used for solid material, varnishes and lacquers, it has wide application. The catalogue has been prepared for general distribution.

The Wetmore Adding Machine Co., of Milwaukee, Wis., manufacturer of computing machines, is to move to Detroit, Mich.

The Hawley Down Draft Furnace Co. of Chicago, Ill., oil furnace manufacturers, have reduced their capital stock from $500,000 to $300,000 and the number of directors from seven to three.

Douglas & Lomason of Detroit, Mich., manufacturers of brass and other metal specialties, hardware for automobiles and automobile specialties, are to erect a new, two story concrete building.

The United States Reduction Co., manufacturers of aluminum, babbitt, and other white metals, have moved from 505 Manhattan Building, Chicago, Ill., to their new offices at 410-426 South Clinton St. where their new Chicago warehouse is also located.

G. J. Nikolas & Co., 1227-1229 Van Buren St., Chicago, Ill., the well known manufacturers of lacquers, are sending out to the trade an unique and useful calendar. It is made practically continuous and is good for 110 years. As sent out, the calendar can be used for years from 1810 to 1920.

The Sharon Iron & Metal Co. has been organized in Sharon, Pa., with a capital stock of $50,000 to deal in iron and brass. They have taken over the business formerly conducted by Carnick Bros. & Speer. They have also secured the plant formerly occupied by the Damascus Brake Beam Co.

The Bruce-Macbeth Engine Co., of Cleveland, Ohio, manufacturers of gas engines, have recently issued a new catalogue of gas engines which they manufacture and which gives various data on the subject. Their engines are made in large and small sizes and are started by compressed air. They are also vertical type.

The Crane Valve Co., of Bridgeport, Conn., manufacturers of iron and brass steam valves, have recently awarded a contract for a heavy machine shop 50 x 353 feet. The contract has been let to the W. H. Boardman Co. of New York City, through the Hooper-Falkenau Engineering Co., of 165 Broadway, New York City, their consulting engineers. This shop will be served by travelling cranes.

The Le Grand Bronze Company of Plainfield, N. J., brass and bronze founders, have purchased a plot of ground in Bayonne, N. J., where a new foundry is to be erected. When completed, the plant will be moved to that location. The foundry will be 40 x 80 feet, one story high and of concrete construction. Eight furnaces are to be installed and a travelling crane.

Rockhill & Vietor, 114 John St., New York City, manufacturers of the "Nonesuch" plating machines, both single and double cylinder, have recently issued a printed instruction sheet giving the necessary data for operating their machines. These instructions are very complete and indicate the care with which the matter has been taken up. They will be sent to those who desire them.

The Wm. B. Faber Co., of Philadelphia, Pa., manufacturers of sterling silver goods, have moved to 733 Sansom St., in that city.

The Standard Galvanizing & Mfg. Co., 726 Canal Road, Cleveland, Ohio, have now incorporated their company with a capital stock of $15,000.

The Davies-Manson Co., of Newark, N. J., manufacturers of jewelry, have been purchased by a new company called the Steeber-Vanderelst Co.

The Mitchell & Van Meter Co., of Pottstown, Pa., and Philadelphia, Pa., manufacturers of plumbers' brass and iron goods, are to erect an addition to their iron works at Pottstown.

The Miami Cycle & Mfg. Co., of Middletown, Ohio, manufacturers of bicycles, are to add two new buildings to their plant. One will be two stories high and the other three stories.

The Patented Specialties Mfg. Co., has been incorporated in Cincinnati, Ohio, with a capital stock of $10,000 and will manufacture metal sash and window frames. The office is at 1610 Reading Road.

L. C. Smith & Bro. of Syracuse, N. Y., typewriter manufacturers, have commenced the erection of their new 8 story factory in that city. It will be 54 x 201 feet and on East Washington St.

The Elizabethtown Smelting & Refining Co. of Lyons Plains, N. J., sweep smelters and gold and silver refiners, are preparing to move their plant in the near future to Newark, N. J.

The Jungers Stove & Range Co., has been organized in Grafton, Wis., and will manufacture stoves and ranges. A new plant will be built and which, it is expected, will be in operation by Sept. 1st.

The Decker Mfg. Co., of Keokuk, Iowa, manufacturers of hardware specialties is erecting a new plant at a cost of about $25,000. It is of brick 50 x 140 feet. The old plant will then be abandoned.

Charles Park, formerly with the Eastwood-Park Co. of Newark, N. J., is to start a factory in that city for the manufacture of sterling-silver and German-silver novelties and toilet goods. The factory will be located in the Crane building.

Fire broke out in the lacquer room of the Stanley Works at New Britain, Conn., on May 9th, and damaged their plant to the extent of $50,000. A large quantity of lacquer was destroyed. Builders' hardware is manufactured by the company and a considerable quantity of finished goods were damaged.

John Hassall, Inc., Clay and Oakland Sts., Brooklyn, N. Y., manufacturers of small nails, escutcheon pins, rivets and studs, is now carrying on barrel electroplating for the trade. All kinds of small metal goods will be brass, copper, nickel, tin or zinc plated and with an excellent color and highly polished.

The Miller Safety Lock Co., recently incorporated in Peoria, Ill., with a capital stock of $2,400 will manufacture safety door locks for elevators.

The Consolidated Hardware Mfg. Co., of Hamilton, Ont., Canada are increasing their capacity by the addition of new machinery. Three times the former capacity is now had.

At the recent meeting of the stockholders of the Excelsior Brass Co., of Reading, Pa., the following officers were elected: President, Herbert E. Woodward; vice-president, George Wicklein; treasurer, Henry Etheridge; and secretary, Louis M. Gantert. Plumbers' brass goods are manufactured.

The plant and business of the American Wire Brush Co., of New York City has been purchased by the Osborn Mfg. Co., of Cleveland, Ohio. The new owners will operate it under their own name and it will be known as the Eastern Division of the Osborn Mfg. Co. The works have been moved from 277 Greenwich St. to 202 Center St., New York City.

Personal.

Sherman Paris has succeeded H. S. Snyder as advertising manager of the Joseph Dixon Crucible Co. of Jersey City, N. J.

John D. Ryan, president of the Amalgamated Copper Co., has been elected president of the United Metals Selling Co. of New York City, to succeed Adolph Lewisohn.

D. W. Robinson, formerly in charge of the plating room of the Blickensderfer Typewriter Co. of Stamford, Conn., has taken charge of the plating rooms of the Remington Typewriter Co. at Ilion, N. Y.

Wiliam A. Spear has become associated with the Cleveland office of the Waterbury Farrel Foundry & Machine Co., of Waterbury, Conn., manufacturers of brass rolling and working machinery, presses, etc.

Reuben Hill, formerly with the New Departure Company of Bristol, Conn., and later with the Hudson Motor Car Co., of Detroit, Mich., has been made general manager of the Detroit Lubricator Co.

Obituary.

Millard F. Willfong, president of the Millard F. Willfong Iron Works Co., of Philadelphia, Pa., manufacturers of galvanizing kettles etc., died on April 9th. He had been the head of the company for 40 years.

Ludwig Wolff, president of the L. Wolff Mfg. Co. of Chicago, Ill., manufacturers of plumbers' brass goods, died at his home in that city after a long illness. He was born in Germany in 1836 and emigrated to this country in 1854. His first employment was as coppersmith for the Chicago & Northwestern R. R.

Current Metal and Supply Prices.

These Prices are net and are for moderate quantities. Smaller quantities command higher prices. Prices subject to fluctuation.

Acetone, pure, 98-99%	lb.	.22
Acid, Acetic, pure, 30%	lb.	.07
Acid, Arsenious (White Arsenic)	lb.	.20
Acid, Benzoic	lb.	.55
Acid, Boracic (Boric), pure	lb.	.12
Acid, Hydrochloric, see Acid, Muriatic.		
Acid, Hydrofluoric, 30%	lb.	.04
Acid, Hydrofluoric, 50%	lb.	.10
Acid, Muriatic, 20°	lb.	.02
Acid, Muriatic, c. p., 20°	lb.	.07
Acid, Nitric, 38°	lb.	.05⅝
Acid, Nitric, 40°	lb.	.05⅞
Acid, Nitric, 42°	lb.	.06¼
Acid, Nitric, c. p.	lb.	.08
Acid, Sulphuric, 66°	lb.	.01¾
Acid, Sulphuric, c. p.	lb.	.06
Alcohol, Wood	gal.	.50
Alcohol, Denatured	gal.	.55
Alum	lb.	.04
Ammonium Sulphate	lb.	.07
Aluminum, Metallic, in Ingots	lb.	.21½
Aqua-Fortis, see Acid, Nitric.		
Ammonia Water (Aqua-Ammonia), 20°	lb.	.04¾
Ammonia Water (Aqua-Ammonia), 26°	lb.	.06¼
Ammonia Water, c. p.	lb.	.08
Ammonium Carbonate, lump	lb.	.15
Ammonium Chloride (Sal-Ammoniac)	lb.	.12
Ammonium Hydrosulphuret	lb.	.30
Ammonium Sulphate	lb.	.07
Ammonium Suphocyanate	lb.	.50
Amyl Acetate	gal.	2.40
Antimony	lb.	.09½
Arsenic, Metallic	lb.	.15
Arsenic, White (Acid Arsenious)	lb.	.20
Argols, White (Cream of Tartar)	lb.	.31
Asphaltum, Commercial	lb.	.05
Asphaltum, Egyptian (Bitumen)	lb.	.30
Benzine	gal.	.15
Benzol, Pure	gal.	.75
Bismuth, Metallic	lb.	2.00
Bitumen, see Asphaltum.		
Blue-Vitriol, see Copper Sulphate.		
Borax, Crystals or Powdered	lb.	.10
Borax Glass	lb.	.35
Cadmium, Metallic	lb.	.75
Carbon Bisulphide	lb.	.10
Calcium Carbonate (Precipitated Chalk)	lb	.10
Chrome-Green	lb.	.50
Copper, Lake, (carload)	lb.	.12¼
Copper, Lake, (cask)	lb.	.12½
Copper, Electrolytic, (carload)	lb.	.12⅜
Copper, Electrolytic, (cask)	lb.	.12⅝
Copper, Casting, (carload)	lb.	.12
Copper, Casting, (cask)	lb.	.12¼
Copper Acetate (Verdigris)	lb.	.35
Copper Carbonate, dry	lb.	.25
Copper Sulphate (Blue-Stone)	lb.	.09
Copperas, see Iron Sulphate.		
Corrosive Sublimate, see Mercury Bichloride.		
Cream-Tartar, see Potassium Bitartarate.		
Cryolite	lb.	.12
Cyanide, see Potassium Cyanide.		
Dextrin	lb.	.15
Emery Flour	lb.	.04
Emery, F F & F F F	lb.	.03
Flint, powdered	lb.	.01
Fluor-Spar	lb.	.01¼
Fusel-Oil	gal.	2.40
Gold Chloride	dwt.	.60
Gum Copal	lb.	.30
Gum Guiacum	lb.	.26
Gum Mastic	lb.	.70
Gum Sandarac	lb.	.35
Gum Shellac, brown	lb.	.50
Gum Shellac, white	lb.	.60
Iron Perchloride	lb.	.25
Iron Sulphate (Copperas)	lb.	.05
Lead Acetate (Sugar of Lead)	lb.	.15
Lead, Pig	lb.	.04½
Lead, Red	lb.	.12
Lead, Yellow Oxide (Litharge)	lb.	.12
Liver of Sulphur, see Potassium Sulphide.		
Manganese, Ferro, 80%	lb.	.10
Manganese, Metallic, pure	lb.	.75
Magnesium, Metallic	lb.	1.50
Mercury Bichloride (Corrosive Sublimate)	lb.	.93
Mercury, Metallic (Quicksilver)	lb.	.52
Mercury Nitrate	lb.	1.50
Mercury Oxide, yellow	lb.	1.80
Nickel and Ammonium Sulphate (Double Salts)	lb.	.16
Nickel Carbonate, dry	lb.	.60
Nickel Chloride	lb.	.50
Nickel Metallic	lb.	.45
Nickel Sulphate (Single Salts)	lb.	.25
Nitre (Saltpetre), see Potassium Nitrate.		
Oil of Vitriol, see Acid, Sulphuric.		
Paraffine	lb.	.15
Phosphorus, yellow	lb.	.40
Phosphorus, red	lb.	1.10
Pitch	lb.	.05
Plaster of Paris, Dental	bbl.	4.00
Platinum Chloride	oz.	25.00
Platinum Metallic	oz.	43.50
Potash-by-Alcohol, in sticks	lb.	.50
Potash, Caustic (Potassium Hydrate)	lb.	.08
Potassium Bichromate	lb.	.14
Potassium Bitartarate (Cream of Tartar)	lb.	.31
Potassium Carbonate (Pearlash)	lb.	.10
Potassium Chlorate	lb.	.15
Potassium Cyanide	lb.	.25
Potassium Iodide	lb.	2.25
Potassium Nitrate (Nitre or Saltpetre)	lb.	.10
Potassium Permanganate	lb.	.17
Potassium, Red Prussiate	lb.	.60
Potassium, Yellow Prussiate	lb.	.24
Potassium Sulphide (Liver of Sulphur)	lb.	.15
Potassium Sulphuret, see Potassium Sulphide.		
Potassium Sulphocyanate	lb.	.70
Pumice, Ground	lb.	.05
Quartz, Powdered	lb.	.01
Rosin, Yellow	lb.	.04
Sal-Ammoniac, see Ammonium Chloride.		
Sal-Soda, see Sodium Carbonate.		
Silver Chloride, dry	oz.	.75
Silver Cyanide	oz.	1.00
Silver, Fine	oz.	.53
Silver Nitrate, crystals	oz.	.50
Soda-Ash	lb.	.05
Sodium Biborate, see Borax.		
Sodium Bisulphite	lb.	.15
Sodium Carbonate (Sal-Soda), crystals	lb.	.02
Sodium Hydrate (Caustic Soda)	lb.	.05
Sodium Hydrate (Caustic Soda) by Alcohol (in sticks)	lb.	.45
Sodium Hyposulphite ("Hypo")	lb.	.04
Sodium Metallic	lb.	.90
Sodium Nitrate	lb.	.05
Sodium Phosphate	lb.	.09
Sodium Silicate (Water-Glass)	lb.	.04
Soot, Calcined	lb.	.15
Spelter, see Zinc.		
Sugar of Lead, see Lead Acetate.		
Sulphur (Brimstone) in lump	lb.	.05
Tin Chloride	lb.	.43
Tin, Metallic	lb.	.41¾
Turpentine, Venice	lb.	.35
Verdigris, see Copper Acetate.		
Water, Distilled	gal.	.15
Water-Glass, see Sodium Silicate.		
Wax, Beeswax, yellow	lb.	.45
Wax, Carnauba	lb.	.70
Whiting (Ground Chalk)	lb.	.02
Zinc Carbonate, dry	lb.	.19
Zinc Chloride	lb.	.12
Zinc, Sulphate	lb.	.06
Zinc, (spelter)	lb.	.05½

THE BRASS WORLD AND PLATERS' GUIDE

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The Crystallization and Season-Cracking of Rolled or Drawn Brass.

As far as our knowledge goes, the appearance of crystallized and season-cracked brass is the same. The fracture, when examined shows a multitude of minute crystal faces, and it is believed that although crystallization may be caused by a different agent than season-cracking, the ultimate effect on the brass is the same—that of changing the structure from an amorphous to a crystalline condition.

Crystallization may be caused by several agencies. Fatigue of the metal in working brings it about. Vibration also causes it, and continual contraction and expansion may likewise bring it about. The final result is that the brass breaks with a crystallized fracture. Hence the name.

It is believed that the majority of cases of so-called crystallized brass are in reality instances of season-cracking and have been brought about by external influences such as atmospheric effects or corrosive liquids. As the actual appearance of the brass is the same, it is quite natural to confuse the terms. The term "distintegration" would, perhaps, be better when applied to certain forms of season-cracking, particularly that which occurs when the brass has been atacked by corrosive liquids.

As far as the season-cracking of brass is concerned we desire to place ourselves on record as saying that we firmly believe that *ammonia* or compounds evolving it is responsible for many, and perhaps most of the cases which are brought to the notice of the

observer. It has been well known for many years that the excrement of animals, which, evolves ammonia upon decomposition, causes brass to season-crack and a large number of cases are known in which portions of the same brass not covered with such excrement remained good indefinitely, while other portions upon which it existed season-cracked badly.

Other marked instances have recently come to our notice in which ammonia water had come in contact with brass tubing and it soon badly season-cracked. Other and more recent examples of the effect of ammonia on the season-cracking of brass sheet is in the well known acetylene generators used upon automobiles. These are made of drawn or spun brass. When the calcium carbide in them is acted upon by the water, acetylene is generated, but as it is made from coal which contains nitrogen, ammonia salts are formed by the action of the water, usually to such an extent that the ammonia smell is quite strong.

We have become so firmly convinced in our own minds that ammonia is the cause of such a large number of cases of season-cracking of brass, that we advise, in all instances where it occurs, to investigate and find out if there is not some ammoniacal compound which has come in contact with it. Many organic compounds generate ammonia upon exposure to the air or in contact with metals.

Why ammonia should cause the crystalization of brass is not well understoood, but it is, without doubt, a very frequent cause.

Overheating Work During Buffing.

Manufacturers frequently find that some of the plated work is coming from the buff room in a cloudy condition. It has the appearance of having an impertect deposit on it, although the solution may be working all right and other pieces, which were placed side by side in the solution, come out all right. In such instances it will usually be found that the surface of the metal has been overheated during the buffing, either before or after plating. It more frequently occurs before plating as the buffer then knows that there is no danger of buffing off the deposit.

The most frequent cases of burning or overheating of articles during buffing are on soft metals, such as britannia-metal, antimonial-lead or pewter. The melting point of these metals is so low that it is not difficult to do it. Brass is also frequently overheated in buffing, while the hard metals such as steel or iron are not subject to it.

With a hard wheel revolving at several thousand revolutions much heat is generated and if a buffer is not familiar with the trade he will believe that simply holding the work against the wheel is all that is required. If he holds it too long, the surface becomes overheated. The structure of the brass or soft metal is then changed and a sort of crystallization follows with its accompanying cloudy effect. In such instances the buffer and not the plater is at fault.

Criticism of Cleaning and Plating at the Same Time.

Many platers have heard that it is possible, by the use of certain plating baths, to clean the work and plate it at the same time. They believe that it is something new.

The process is not only old but far from good practice. It is based upon the use of a hot cyanide plating solution, particularly a hot cyanide copper bath.

It has been known for a long time that a hot cyanide copper solution has grease removing powers. In fact, this is one of the reasons why it is used. It is not necessary to use any special formula, however, as any hot cyanide copper solution will answer; but it should be known that all hot solutions must be weaker than cold ones on account of depositing their metal faster.

Although a hot cyanide copper solution has grease removing properties, it hardly seems logical to allow it to remove grease and oil from the surface of the work to be plated and thus become contaminated. It is then only a matter of a short time when the surface of the solution becomes covered with a layer of the grease and covers the plated work when it comes from it. The cyanide is then used up more rapidly and there is little to be gained.

The grease removing properties of a hot cyanide copper solution are excellent, but are intended to take off the slight film which may be present from handling or otherwise and *not* to supplant the regular cleaning kettle.

The Manufacture of Soft Solders and the Method Employed in Testing Them; With Notes on the Use of Scrap Metals.

Ordinary soft solder composed of tin and lead is the most extensively used white metal. There are very few metal manufacturing establishmnts in which it is not employed, and in the plumbing and tinsmithing trades it is, of course, universally employed. To many persons, solder is solder, but the expert worker soon is able to ascertain whether it is good or bad. Each line of trade has its peculiarities and the solder must be adjusted for the purpose. In many classes of industries a poor grade of solder, made from scrap and containing antimony, may be used with good results. In others, the requirements are so severe that nothing but the best grades of pure tin and lead can be employed.

Soft solder, as the term is ordinarily used, consists of tin and lead. The proportions will vary according to the use to be made of it. Ordinary tinners' solder is usually composed of equal parts of tin and lead, and is known as "half and half". The best grade of soft solder is made of two parts of tin and one part of lead as it has the lowest melting point. Wiping solder, used by plumbers for wiping the joints on lead pipe contains 2 parts of lead and 1 part of tin. Unless this mixture is made of such proportion, the joint

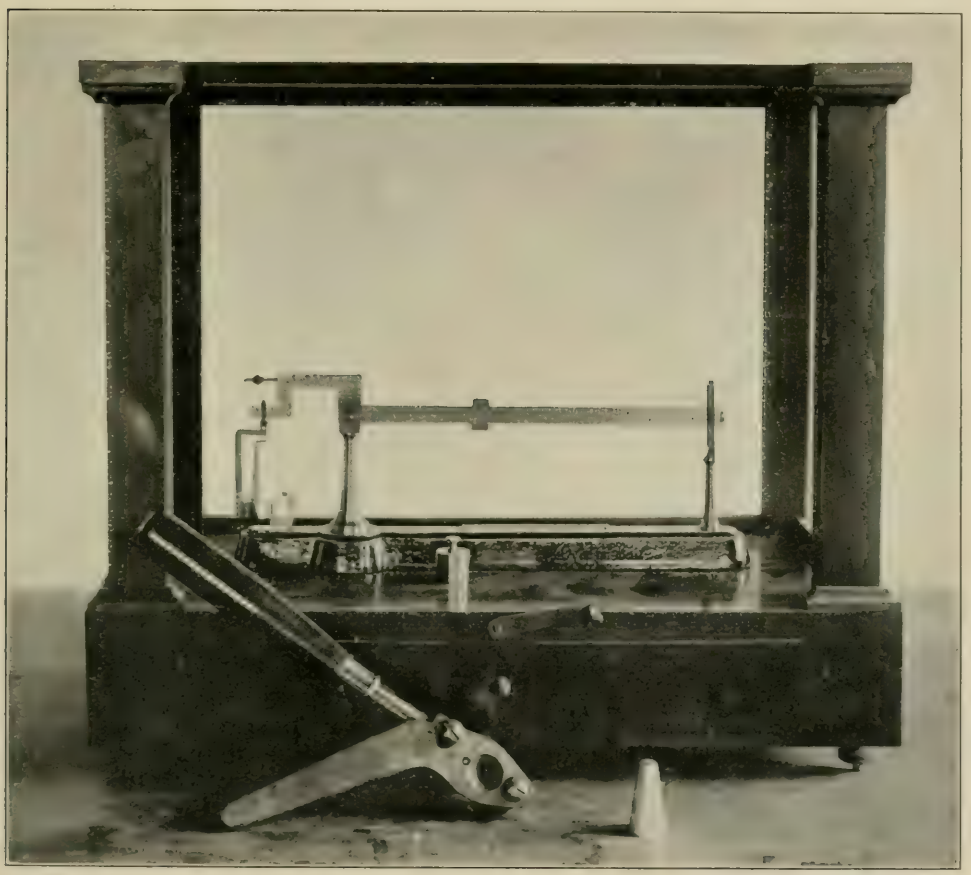


Fig. 1. The Solder Testing Scales, Showing Mold and Bullet Cast from the Solder for Testing.

cannot be wiped, as the other mixtures do not have the property of becoming "plastic" when cooling from the liquid condition.

The production of soft solder is now confined to two classes of manufacturers:

1. Manufacturers that use nothing but new tin and lead.

2. Manufacturers that use only scrap metals.

To be sure, some manufacturers use both new and scrap materials, but as a general rule, it will be found that there is a distinct line drawn in the trade between those who use old and those who use new metals. Many solder manufacturers are known that never had any new metals in their establishments, and others are making solder from new metals entirely. Solder users are found that say they do not see any difference between the solder made from old metals and that made from new, and when this is the case, the old material is just as good for them, perhaps, and with a considerable saving in cost. It stands to reason, however, that solder made from new metals is superior to that which has been made from scrap.

After thoroughly stirring, the dross is skimmed off from the surface of the metal as completely as possible and it will be found that the surface is still covered with a light film of oxide that it is impossible to remove by the skimmer. To collect this, throw a handful of common rosin on the surface and wait for it to melt. Then stir in and skim off, when it will be found that the surface of the solder is perfectly clean and clear. Rosin is the best flux for soft solder when new metals are used.

The solder thus cleansed by the rosin is ready for pouring. There is no "secret" about the making of the solder bars. The shape of the standard bar is shown in Fig. 2 and the molds are now made ready for use by mold makers who make a specialty of this class of work. Cast-iron is the best metal for them as it is cheap, hard and the solder, even when overheated, will not adhere to it as it does to a brass or bronze mold.

In pouring the solder, the object is to produce as smooth a bar as possible, particularly on the top as this is what the customer notices first and determines the value of the solder

Fig. 2. A Bar of Commercial Solder Branded "Half and Half". This Bar When Tested on the Scales Showed 43 Per-Cent of Tin.

Making From New Metals.

The making of soft solder from new metals is a comparatively simple operation. Straits tin and desilverized pig lead are used. In other words, the purest tin and lead on the market are generally employed. The melting is carried on in an iron kettle heated from underneath. The tin and pig lead are placed in the kettle together and when melted the whole is very thoroughly stirred with an iron stirrer of some kind. A flat, paddle-shaped tool is preferable as the stirring then becomes more effectual than when a round rod is employed. Complete stirring should be carried out as the lead, being so much heavier than the tin, has a tendency to settle to the bottom of the kettle.

under ordinary conditions. The clean, bright surface on the top of the bar of solder is obtained by pouring at the right temperature. The molten metal should be poured at as low a temperature as possible and still have the mold fill well. Experience will soon determine this point, and care must be taken to keep the temperature of the solder in the melting kettle down to the right point by the addition of cold metal. Unless this is done, the fire underneath the kettle constantly increases the temperature of the solder until at the last pouring it has become quite hot. By pouring the bars at the lowest possible temperature, therefore, the desired appearance will be obtained. If poured too hot, the surface will be rough and oxidized with too

much depression produced by shrinkage. The molds must also be constantly cooled by immersing in cold water, otherwise they will gradually become overheated and cause the cast bar of solder to have an unsatisfactory appearance.

The method of procedure in the making of soft solder from new metals is the same whatever the mixture.

Making Solder From Scrap Metals.

The greater proportion of solder used is made from scrap metals and the reason for its

Fig. 3. Solder Before Treating with Flux.

extensive consumption is the low cost. Not only does the consumer pay a less price for it, but the maker obtains a greater profit thereby.

The usual scrap metals employed in making soft solder are old lead pipe and block tin pipe. The various drosses are also used after first having been smelted. Tea-lead, pewter, britannia-metal, babbitt-metal, and any other lead or tin materials are also frequently employed. The presence of a small quantity of antimony in these metals (except the tea-lead which contains none) is not taken into consideration as nearly all commercial solder made from scrap materials contains it and it has not been found a serious detriment unless over 5% is contained in it.

The materials generally used in making soft solder from scrap metals are old lead pipe, lead pipe joints (which contains considerable solder) and block tin pipe. These are placed in the kettle in the right amounts, as in case the solder is made from new metals, and when the whole has been melted, the dross is skimmed off as usual. The use of rosin as a flux at this stage is usually not efficacious in case the scrap metals contain considerable impurities, although it may be tried and if the surface of the molten solder remains clear it will be all that is necessary. In case the scrap metals contain copper or zinc (or frequently iron) a different flux may be necessary. After thoroughly stirring the molten solder in the kettle, throw a handful of the following flux on the surface and stir in:

Fig. 4. Solder After Treating with Flux.

Flux For Solder Made From Scrap.

Sal-Ammoniac	4 lbs.
Sulphur	2 lbs.
Rosin	1 lb.
Powdered Charcoal	1 lb.

The, after allowing the flux to act, skim off the dross which has formed and repeat if necessary. This will serve to cleanse the metal from impurities. When the surface

remains clean and bright, the solder is ready for pouring.

The pouring is carried out in the same manner as that followed in the case of new metals in order to obtain a bar of solder having the necessary good surface.

The effect of this flux in cleansing or purifying solder made from scrap materials may be appreciated by referring to Figs. 3 and 4. In Fig. 3 is shown the solder before treating with the flux, while in Fig. 4 the same solder after the flux has been used may be seen. The flux has proved to be excellent for the purpose.

be tested in order to ascertain what the product in the form of solder actually is.

For the rapid and accurate testing of solder, the so-called solder testing scales have proved very satisfactory and will be found useful in many establishments. This method of testing solder was, it is believed, first brought before the public by the late J. W. Richards of the Delaware Metal Refinery of Philadelphia, Pa., and described by him in the Journal of the Franklin Institute in 1898. The balances are now made for the trade by Hermann Kohlbusch Sr., 170 Broadway, New York City.

The principle of the balance lies in the fact

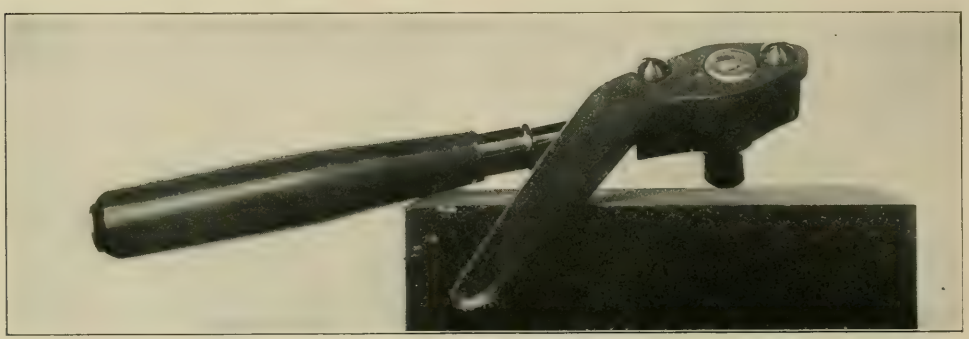


Fig. 5. The Mold for Casting the Solder Bullet, Just After the Bullet Has Been Cast.

When solder is made from new tin and lead, there is little need of testing it, as far as the manufacturer is concerned, although the consumer is quite justified in testing it to ascertain whether he is obtaining full value

that the specific gravity of tin and lead vary to such an extent that any change in the percentage in the tin or lead content of the solder is readily noted on the balance beam. To carry out the method of testing it is nec-

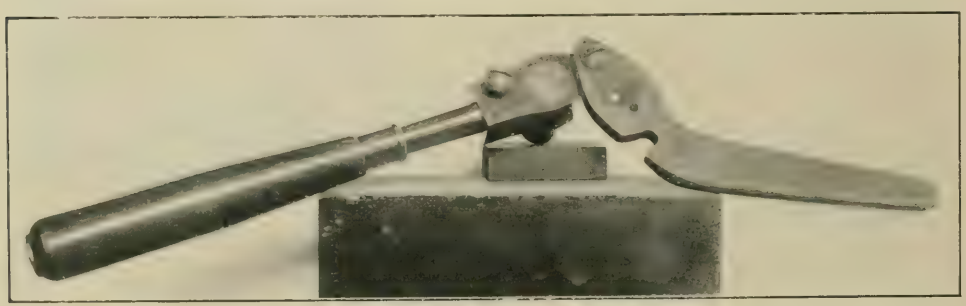


Fig. 6. The Mold Open Showing the Bullet in It. The Lever Has Automatically Cut off the Gate.

for his money. In the case of scrap metals, though, there must be some means of testing the solder, otherwise the manufacturer may cheat himself or his customer very badly. The composition of the scrap, is an unknown quantity and the solder made from it must

essary only to cast the same size bullet each time so that the mass of metal may always be uniform.

As now made, the solder testing scales consist of a base and scale beam with a pan at the end. Such a scale is shown in Fig. 1.

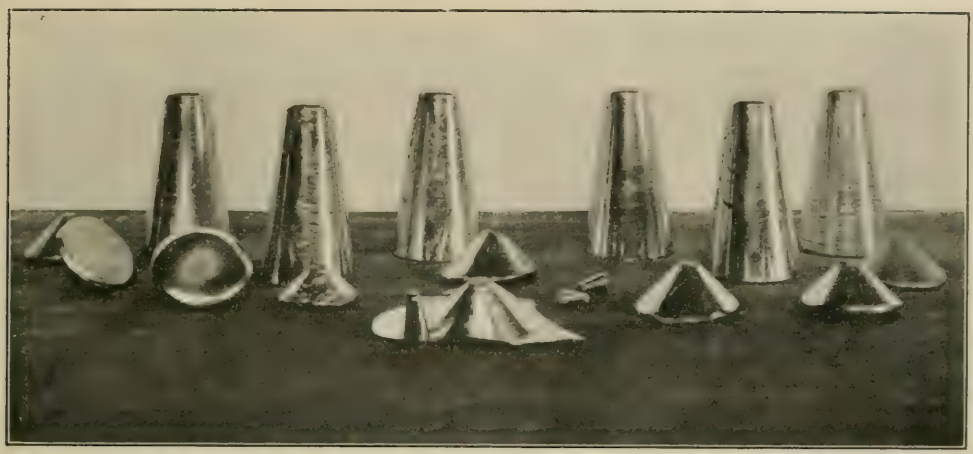


Fig. 7. A Lot of Solder Bullets for Testing. Showing the Gates and Vents of Same.

The pan at the end is used for holding the cast bullet. A counterpoise is used on the beam and graduations on the latter show the percentage of tin in the solder.

For casting the bullet used for testing the solder a mold is supplied which allows a

Fig. 8. The Bullet Cut in Half, Showing How a Cavity May be Present to Cause Erroneous Results.

bullet of the shape of those shown in Fig. 7 to be cast. The bullet is made of this shape so that it is easily removed from the mold, and the mold is so constructed that the gate and vent are cut off by the lever at the top. A clean top is thus produced. The mold with the bullet just cast is shown in Fig. 5, while in Fig. 6 the mold is illustrated when opened with the gate automatically cut off.

To use the mold, the solder is poured from an ordinary hand ladle into the gate of the mold until it is full and runs up into the vent at the top. When cool, the lever is pushed one side, cutting off the gate and vent and leaving the top of the bullet smooth. The bullet is then readily removed when cool.

The bullet thus cast is then placed on the balance pan and the counterpoise moved until the beam balances. The divisions on the beam are then read off giving the percentage of tin in the solder. For example, the beam itself is shown in Fig. 10 and it had been used for determining the percentage of tin in a solder. As it stands, the solder contained 29% of tin. The simplicity of the method of testing the solder will at once be appreciated. It is possible to determine the percentage of tin in a

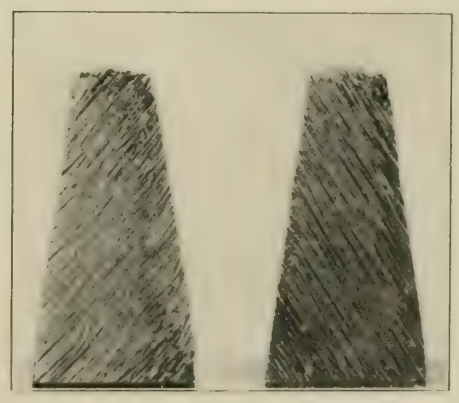


Fig. 9. The Bullet Cut in Half Showing Sound Casting.

sample of solder within a few minutes. The balance, of course, is the lead and it is unnecessary to determine it. The scales are quite accurate and the tin may be determined to one-half or one-quarter of a per cent.

which is much smaller than is ever necessary in practice.

When antimony is present in the solder, the accuracy is not as great, but there is a slight error introduced. The amount of antimony in commercial solder is usually so small, however, that it is not taken into consideration and the method is used in the ordinary manner. It may be said, however, that inasmuch as antimony has a specific gravity near that of tin, it is figured as tin when the solder is tested.

In casting the solder bullets for testing, care should be taken not to cast them at too high a temperature or an error will result. Under certain conditions, principally on account of pouring too hot, the center of the bullet is apt to come with a cavity in it as shown in Fig. 8. When such a difficulty occurs, the outside appearance of the bullet may be good and show no indication of the cavity. The results obtained in testing, however, are inaccurate and should be discarded. To make sure that there is nothing but solid metal in the bullet, it should be cut in half and examined. When perfect, it will have the appearance indicated in Fig. 9. When a number of bullets have been cast and they all show the same results, it is likely that none are unsound. In instances where only one bullet can be cast, it is usually unsafe to accept the result of the scales without cutting the bullet in half in order to ascertain whether it is sound or not.

There are but three solder mixtures in general use. These seem to satisfy the trade and there is little call for others. To be sure, we have such grades as "half and half" and strictly "half and half", but these are meaningless. The following will indicate the three commercial solders as now produced:

Ordinary Half and Half Solder.

Tin	50% or 1 part
Lead	50% or 1 part

Best Grade of Solder.

Tin	66% or 2 parts
Lead	34% or 1 part

Wiping Solder.

Tin	34% or 1 part
Lead	66% or 2 parts

In the manufacture of solder, the brand or name on the bottom of the bar is no indication as to the actual composition except in the case of wiping solder in which there is no desire to cheat on account of its being the cheapest mixture. In the case of the other mixtures, however, there is always such a disparity between the price of tin and lead, that the consumer must always be on his guard in order to ascertain whether he is obtaining full value. The solder scales, however, will always indicate whether this is so or not.

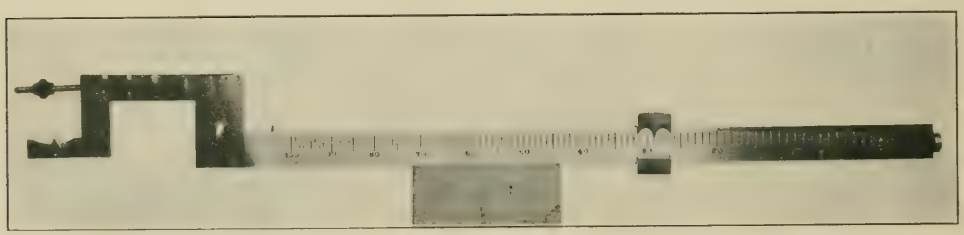


Fig. 10. The Beam Showing Graduations. The Counterpoise Shows 29 Per-Cent of Tin.

A New Aluminum Alloy.

According to a British patent recently issued to G. Jacquier of Johannesburg, Transvaal, the following alloy has particular non-corrosive properties:

Aluminum	92%
Copper	5%
Bismuth	2%
Silicon	1%

The silicon is introduced as silicon-copper. The aluminum is introduced after the other metals have been melted.

Another alloy is also given:

Aluminum	91%
Copper	5%
Bismuth	2%
Magnesium	2%

The metals other than the aluminum are first melted together as previously mentioned, and the aluminum then added.

Separation of Platinum and Gold from Old Jewelry, Filings and Wastes.

Now that platinum is used so extensively in the manufacture of jewelry, and will probably be used still more, its separation from gold and silver is a subject that is of interest to manufacturing jewelers and refiners.

The platinum must be separated in the wet way for there is no other process known. When the method is understood, it is not a difficult one, but there are many pitfalls and unless these are known only a portion of the platinum is recovered. Many a refiner has discovered this to his sorrow when he has figured up his results.

Platinum is used in the manufacture of jewelry in various ways. It is employed in diamond ring settings as the backing to give brilliancy to the diamond. It is also employed as a portion of jewelry itself in conjunction with gold. It is not used to alloy the gold at all, however, and when the platinum is found on the jewelry it can always be seen. Then, of course, there are filings, scrap and similar wastes which form the principal portion of the material obtained from manufacturing jewelers and which is sent to the refiner.

In refining such precious material it will be found that gold, platinum, copper and silver are present. The gold and platinum form the principal portion of the material while copper and silver are present as the alloy, and perhaps the solder. The first operations is as follows:

Melting the Metal.

The usual practice is first to melt the gold and platinum material with silver so that parting can take place. Take the following:

Gold and Platinum Material..1 part
Fine Silver.....3 parts

Melt the whole at a good, bright, red heat in a graphite or clay crucible, pour in to a mold and then roll down into as thin sheet as possible. This is to allow the parting to be done easily.

Parting.

It should be borne in mind that the parting should *not* be done with nitric acid. This is one of the pitfalls. Strange to say, platinum when alloyed with silver, is dissolved to some extent by the nitric acid. In fact, when only 5% of platinum is alloyed with the silver it will dissolve in the nitric acid with the silver. Percy, the celebrated metallurgist, made investigations on the subject and says: "An alloy of platinum and silver, containing only 5% of the latter, completely dissolves in nitric acid, but if the platinum much exceeds that proportion, part of it remains undissolved. But in sulphuric acid only the silver dissolves."

It is necessary, then, to use sulphuric acid for the parting, otherwise the platinum will dissolve with the silver. Place the rolled strip of metal obtained in a porcelain dish, if the quantity is small, and if large a heavy cast iron kettle can be used. For every ounce of the rolled strip, take from 2 to 3 oz. of strong sulphuric acid. This acid should be chemically pure as the presence of chlorine or other impurities will interfere. Heat the dish on a sand bath until the action ceases. This takes several hours. Then allow to cool and pour off the acid, which now contains the silver as sulphate, *into* cold water. For every part of the acid, use 9 parts of water. When all the acid has been poured in, wash the residue in the porcelain dish (which now contains the gold and platinum) with water several times and pour into the main solution.

Precipitation of the Silver.

Heat the silver solution, made by pouring the sulphuric acid into water, so that all the sulphate of silver will dissolve and then precipitate it with copper wire or sheet copper. The silver is precipitated in a finely divided condition and can be filtered off, washed with water and melted down to fine silver. The solution from it contains sulphate of copper and may be crystallized out by evaporation if desired.

Dissolving the Gold and Platinum.

The residue, left after parting with the sulphuric acid, contains the gold and platinum. Wash well with hot water to free from the sulphate of silver, and then dissolve in the porcelain dish with aqua-regia (3 parts of pure muriatic acid to 1 of pure nitric acid). Warm the dish on the sand bath until dissolved. Use no more acid than is necessary and then evaporate off excess until the solution becomes syrupy. It will have a dark red color. The

gold and platinum are now in the form of chlorides and the nitric acid has been expelled by the evaporation.

Add twice the volume of water to the platinum and gold chlorides that there is solution, and it will be found that it is not clear. There will always be a slight amount of silver chloride in it as the sulphuric acid will not remove all. Filter this silver chloride off.

To the clear solution, add ammonia until the free acid in it is *nearly* neutralized. Do not by any means add enough to neutralize the acid or the gold will come down. This point is easily ascertained by the use of test paper. Add the ammonia until the solution just barely colors blue litmus paper red. This point is a delicate one and much care must be exercised in not carrying the addition of ammonia too far. The reason is this: If the free acid in the gold and platinum chlorides is not practically neutralized, all the platinum will not be precipitated by the ammonium chloride afterwards added. If too much ammonia is added so that the solution becomes alkaline, both the gold and the platinum will be precipitated. The right point is just short of neutralization so that the solution still remains slightly acid.

Now add a strong solution of ammonium chloride (sal ammoniac) and stir. The ammonium chloride solution should be saturated. Add enough to precipitate the platinum as ammonium platinic chloride. This comes down in the form of a yellow, crystalline precipitate. As it is not very insoluble in water, it is necessary to add alcohol. Add an equal volume of grain alcohol and allow the whole solution thus obtained to stand in a warm place for 24 hours. Then add more of the ammonium chloride solution to ascertain whether the platinum has all been precipitated and allow to stand for several hours again.

Filter off the ammonium platinic chloride and wash with a mixture of equal parts of alcohol and water. When washed it is thus free from gold.

Obtaining Metallic Platinum.

The ammonium platinic chloride thus obtained is dried and then separated from the filter paper. The filter paper is then burned to an ash and the whole added to the precipitate. The whole is next placed in a crucible (if a small quantity a porcelain crucible is used, but if a large amount a French clay crucible is necessary) and heated gradually to a red heat. Care must be taken at first to avoid too rapid heating so as to lose any of the platinum by "dusting." The ammonium chloride in the precipitate is driven off by the heat and finely divided metallic platinum is obtained as the residue. This is in the form of a black, heavy powder and is called "spongy platinum."

This spongy platinum may be used for making platinum chloride or any other salts of the metal. If, however, it is necessary to obtain it in the compact form, it must be fused in a lime crucible by means of the oxy-hydrogen blowpipe or by means of an electric furnace. It has been found expedient, when thus melted, to allow the platinum to remain in the crucible after it has been melted and not attempt to pour it. It can then be rolled or drawn as desired.

Recovering the Gold.

The solution obtained after filtering off the ammonium platinic chloride contains the gold. To separate it, add a strong solution of ferrous sulphate (sulphate of iron) and heat gently in a porcelain dish for several hours when the gold will all be thrown down in the metallic form and in a very finely divided condition. Add more ferrous sulphate solution, however, to see if all the gold is down and then allow to remain while warm.

Filter off the metallic gold, dry and melt in a crucible under borax as a flux when metallic gold will be obtained. The filtrate from the gold contains nothing of value. The copper, slight amounts of zinc and cadmium, should they be present in the original material, are in the solution obtained by throwing down the silver with the copper and are thrown away.

Recapitulation.

The various steps in the process may be summed up as follows:

1. Melting the gold and platinum material with 3 parts of silver.
2. Parting by sulphuric acid.
3. Separation of the silver in the sulphuric acid solution by metallic copper.
4. Dissolving the gold and platinum residue with aqua-regia.
5. Evaporation of the free acid.
6. Precipitation of the platinum as ammonium platinic chloride by means of ammonium chloride.

7. Filtering out the ammonium chloride, washing and heating to convert into spongy platinum.

8. Precipitation of the gold by ferrous sulphate, washing the gold and melting to fine gold in a crucible.

An Improvement in Galvanizing.

An improvement in galvanizing has been discovered and patented by Herman J. Lohman of Jersey City, N. J., (U. S. Patent 990,443) and which, it is claimed, will render the coating of zinc more adherent than when done by the ordinary galvanizing process. Although the process may be applied to coating iron or steel with zinc, tin or lead, the inventor prefers to use an alloy of the following ingredients for the purpose:

Zinc	10 parts
Lead	10 parts
Tin	1 part

It is claimed that this alloy possesses such flexibility that the sheet which has been coated may be bent without cracking it. It is also more non-corrosive than zinc itself.

The essential feature of the process is in the use of mercury for a preliminary coating and, it is stated, that it serves to bind the coating metal firmly to the iron or steel. In this manner it apparently acts like the well known "quick-dip" used in silver plating German-silver and other similar goods.

The iron or steel to be coated is first pickled in the usual manner and then immersed in the following solution:

Muriatic Acid	5 gallons
Corrosive Sublimate	8 oz.
Sal-Ammoniac	8 oz.

The iron or steel is left in this solution for about three minutes and is then heated to decompose the mercury salt, after which it is immersed in the bath of molten metal.

The article to be coated, after treatment with the mercury solution and heating, is allowed to remain in the bath of molten metal for about three minutes or until it has attained the temperature of the metal. It is then removed when it will be found, the inventor says, that the coating is so adherent that no line of demarkation can be found between it and the base metal of iron or steel.

Production of Imitation Gemmed Jewelry by Means of Lacquer.

A method of producing cheap jewelry so that it will resemble that containing gems, has recently been patented by Frank J. Lightbody of the Cambridge Novelty Co., of Cambridge, Mass., (U. S. Patent 992,014). The method of producing this effect is principally by the use of lacquer. The inventor describes his method as follows:

Fig. 1.

Fig. 2.

Fig. 3.

The Method of Making the Imitation Gemmed Jewelry.

"In the drawings, an ornamental metallic body is represented which may be of any suitable form, and is preferably pressed from a flat sheet metal blank by dies which impart any desired ornamentation to the outer surface of the body. On the outer surface of the body I form by the action of suitable dies a group of facets, the die which forms the exposed surfaces of the facets being suitably compressed between the dies so that the facets are formed with very smooth surfaces adapted to reflect light. The facets are preferably radially arranged and preferably constitute the outer side of a boss which projects from the surrounding portion of the body. The facets are also preferably slightly concave, as indicated by Fig. 2. The combined area of the facets is less than that of the body, so that the body has an exposed surface outside of

the group of facets which preferably has a somewhat dull finish contrasted with the smooth finish of the facets, the said contrasted surface being indicated by the stippled portions in Figs. 1 and 2. The relative arrangement of the facets is such that their light-reflecting surfaces are adapted to reflect light in various directions, thus producing numerous reflected high lights, which give an effect similar to that given by the facets of a gem formed by cutting or pressing glass, or other material of which gems, or so-called gems, are ordinarily made.

To the light-reflecting surfaces of the facets is applied a coating of lacquer, or other transparent coloring matter, which is colored or tinted to impart the desired color or tint to the reflected light. The coating heightens the contrast between the facets and the adjacent surface or surfaces of the body and imparts a tint to the reflected light resembling that of a colored gem, such as a ruby or emerald, the tint depending on the color of the coating.

The described article may be very inexpensively manufactured and presents an effect closely resembling that of a metal body and an actual gem, so called, set therein."

Effect of Quenching on Bronzes.

Seeing that quenching crude, cast bronzes in water at suitable temperatures lessens the hardness of the metal and increases its power of resisting shock. Grenet, in *Revue de Métallurgie,* argues that a subsequent reheating to a temperature below the transformation point would restore the metal to the same physico-chemical condition which it would have if cooled slowly, and would render it harder than if reheated to a higher temperature. This opinion is confirmed by corresponding tests made with 85 : 15 and 80 : 20 bronzes, the maximum hardness being attained by reheating to 250° and 200° C. respectively after quenching at 750° C. in water. The author considers it possible that a recooling in liquid air would have the same effect as in the case of steel (austenite) and increase the hardness still further; and that such a method of treatment is capable of having interesting practical consequences.

New Method for Electroplating Aluminum.

A new method for electroplating aluminum has recently been patented by Carl Rümpler of Schöneberg, near Berlin, Germany. He claims that the difficulty of plating this metal lies in the first flash of deposit and if a very slight film of a brass deposit is put on (containing as much zinc as possible) other deposits may afterwards be put on in the usual manner.

As a deposit for this film, he recommends a brass which contains not less than 50% of copper. In order to obtain the desired brass deposit, a small quantity of a haloid such as potassium chloride, bromide or iodide is used in the plating bath. He states that the less zinc the brass deposit contains, the more tenaciously it adheres to the aluminum. The brass solution which he recommends is made as follows:

Water	1 gal.
Double Potassium and Copper Cyanide	5 oz.
Double Potassium and Zinc Cyanide	2 oz.
Sodium Sulphite	5 oz.
Caustic Potash	2 oz.
Potassium Chloride	1 oz.

Brass anodes are used and about 1.8 volts on the current with a current density of from 2 to 3.6 amperes per sq. decimeter. The time taken in the formation of the film is from 1 to 2 minutes. After this the current should be stopped and the aluminum transferred to the regular solution for the final deposit.

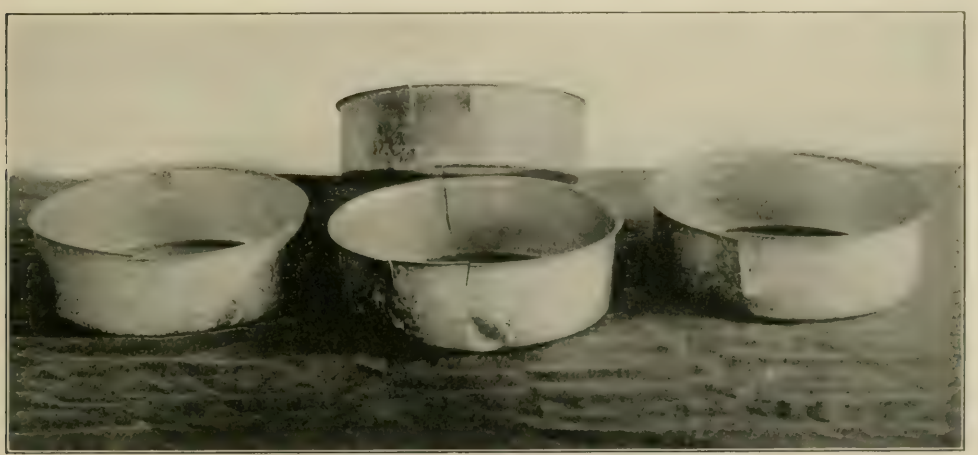
Use of Glass Beads in Plating Barrels.

In a British patent recently issued to S. Consigliere of Genoa, Italy, the use of glass beads or similar hard vitreous material is advocated for use in a plating barrel when plating small articles. It is claimed that the beads act favoraby in polishing the surface of the metal deposit on the surface, just as steel balls act in burnishing metals by tumbling. Were it not for the fact that steel balls would become rapidly coated over in a plating barrel, they could be used to an excellent advantage. The glass, however, being non-conducting serve a similar purpose. How efficacious they are is unknown as it may be difficult to obtain them sufficiently smooth and hard.

The Fire-Cracking of Drawn Steel Shells During Galvanizing.

The fire-cracking of soft steel is not a common matter and the following experience of one of our subscribers will undoubtedly be of interest. The shells were made of soft steel, drawn up into the shape shown by means of the press. Our correspondent supplies the following information:

"We recently had an experience here and I wonder if any light could be shed upon it. We made several thousand shells of annealed steel. The shells (herewith illustrated) are about 8 in. in diameter and 3½ in. deep with a raw edge.



The Galvanized Sheet Steel Pans Which Fire-Cracked When Galvanized on Account of Absorption of Hydrogen During Pickling.

When these shells came from the presses, it was possible to bend them into oval shape without cracking or bending of any kind, but the minute we pickled them and put them through the acid and galvanized them, they would crack and break by ordinary handling.

To overcome the trouble, we tried a cold pickle and found it made no difference. We also weakened the pickle without any result. We found, however, that if we did not pickle them, but put them through the galvanizing process without this preparation, no breakage occurred.

We sometimes have a similar case in retinning tin shells. Can you enlighten us as to the reason for this apparent phenomenon?"

(The difficulty is apparently caused by the occlusion of hydrogen gas during the pickling, which renders the steel more or less brittle. It is well known that hard steel, such as wire or sheet springs, cannot be electroplated in cyanide solutions without breaking while afterwards in service. In case a strong current is used, the breakage may occur in the solution while the plating is going on. This breakage is caused by the occlusion of hydrogen gas, which is given off freely from the surface of the work during the plating operation. This hydrogen absorption or occlusion seems to render the steel brittle, and it takes place during pickling as well as during electroplating.—*Editor.)*

Soft Toned Bells in China.

The natives of China use large bells of their own make in many of their temples and monasteries. I have noticed all through Japan and China that the tone of the monastery and temple bells is very soft and smooth, due to the superior quality of the material used in their manufacture and to the absence of iron clappers, the result being a marvelous softness and mellowness of tone. The bells are never swung, being always suspended in a fixed frame, and the sound is produced by striking them on the outer edge with a wooden mallet. This makes the soft tones which are so delightfully melodious.—*Consul Samuel L. Gracey in Daily Consular Report).*

Non-Ferrous Foundry Economies and Refinements.*

By E. A. Barnes.†

In order to get the best results out of any foundry, it must be the concern of the management not only to take into account the large and apparent items of loss, but to give attention to the minutest details. This is where the intelligent work done by technically educated engineers and chemists can be of great assistance. Up to a few years ago, a brass foundry was either an adjunct of the iron foundry or considered one of the least important departments of any manufacturing industry and even today one can visit large, pretentious plants in which the brass and aluminum foundry is apparently of minor importance. The turning out of the necessary castings from which costly appliances are finally produced, does not receive the expert attention as does the factory itself in which latter labor-saving devices and schemes of all kinds are found to exist. Many of these foundries are presided over by foundrymen, who by reason of their experience are virtually autocrats and dictate the policy of the foundry methods. This kind of foundry is usually poorly laid out, illy lighted and the work is done at a disadvantage. This class of foundry, I am glad to say, is fast disappearing, being superseded by those in which engineering skill is employed in the design, equipment and production, and in place of compounding metals from empirical formulae, known usually only to a favored few in the institution, the metals are scientifically compounded from data furnished, classified and checked by an engineer or chemist, whose duty it is to investigate and produce alloys suited to each peculiar requirement.

The modern foundry, in place of being relegated to the basement or some lean-to at the back of the works, should be designed expressly for the purpose, having in mind not only rapid and economical production, but the scientific handling and storing of the raw materials, keeping account of the same until they are used on the floor or melted in the furnaces and finally weighed up and turned over to the factory in the form of finished castings.

The building should by all means be fireproof. Many designs lend themselves to non-ferrous metal foundry practice—the saw-tooth having its advocates where land is cheap, and the gallery or many-storied buildings where land is at a premium. My preference is for the gallery construction. The lighter brass work and aluminum work can be carried on in the gallery where there are ample light and air The first floor can be used for the heavier work, the scrap melting furnaces, the power plant, office, cleaning departments, store rooms and other miscellaneous uses not strictly connected with the actual melting and moulding.

Heating—The heating of a foundry is one of the important considerations. I personally prefer to use direct radiation, derived either from coils of iron pipe built along the walls under the windows, or sectional cast iron radiation similarly placed. With a little scheming this radiation is out of the way of the moulders' benches, moulding machines and sand. Placed under the windows it radiates the maximum amount of heat, tempering the air and distributing it evenly over the building.

Ventilation—Ventilation is another important point that must be taken into consideration. In saw-tooth and gallery constructed buildings, the lanterns in the roof should be arranged with swinging windows; the natural tendency of the heated gases being to rise and pass out of the same. This action can be augmented by the use of fans, which are absolutely necessary in a building built of more than one solid story.

Office—The foundry foreman's and clerk's office should be arranged so as to afford a full view of the shop, yet be quiet and so closed in as to be free from the dust and dirt that are inseparable from any foundry. Suitable desks, chairs, card indexes, filing cabinets, etc., should be supplied, as no foundry can be properly conducted unless adequate means are at hand with which to keep records of weights, input and output.

Pattern Storage—We have found that the best form of pattern storage is secured by the use of heavy wire netting mounted on light angle iron supports. These racks are fire-proof, the sand that sticks to the patterns eventually falls off, sifts through the meshes

*A paper read at the meeting of the American Brass Founders' Association, held in Pittsburgh, Pa., May 22-27, 1911.

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and in place of remaining among the patterns, gravitates to the floor where it can be swept away. The racks being open permit of inspection and ready identification, even if the pattern is ranged on one of the upper shelves. They are strong and practically indestructible. Some system of numbering and arranging these patterns is, of course, necessary. The match plates can be stored standing on edge in suitable metal racks and receptacles where the chance of injury is remote.

Metal Storage—When it comes to the storage of expensive metals and supplies, and fireproof vaults, centrally located, not only to the melting floors and office, but to the freight elevator which serves the upper stories, it may be even advisable to build store rooms on the upper floors, connecting these with the main floor storage by limited capacity electric hoists.

Sand Bin—The sand bins should be so arranged, that the sand can be unloaded through adjustable chutes or conveyor system from freight cars or wagons economically and rapidly, and be distributed only as occasion requires to the moulding floors and core room.

Crucible Storage—In our foundry we have arranged the store room for crucibles, fire brick lids and other supplies that are likely to be affected by the absorption of moisture, in a brick vault heated to a considerable degree by the passage of spent furnace gases through suitable ducts under the floor of the vault. Shelving is arranged in this vault for the storage of cores that have been baked but are not yet required.

Core Oven—For a number of years we have successfully employed a core oven built in line with the main flue gas vent. The spent gases from the furnaces pass through cast iron ducts built to constitute the floor of the core oven. These ducts are controlled by hinged dampers which can be deflected so as to pass the gases directly up the stack. When it becomes necessary to bake large cores, the heat in this oven is augmented by the use of an oil burner connected to the main fuel system.

Welfare—It is desirable and it is in fact becoming a law in many States, that a foundry shall be equipped with suitable toilet rooms in which modern conveniences must be installed. In our foundry we have individual, hygienic wash bowls allotted to each employee, with running hot and cold water. Each man is furnished with a metallic locker in which to store his street clothes. Shower baths, needle baths and dressing rooms are provided with hot and cold water. With these facilities, the men can make themselves entirely comfortable and presentable before leaving the premises. One of the floor helpers acts as janitor for this department and keeps it in a sanitary condition. It is an undeniable fact that these accommodations are not only used but are appreciated by the men. To the unprogressive manager, these things appear unnecessary refinements, but our experience of several years has proven to us conclusively that for our forethought and outlay we get a better class of men and a higher grade of work with less complaint than was possible before these arrangements were installed.

Power Plant—One of the principal features of foundry installation is the power plant. In the power plant are situated the pumps for pumping the oil, the operation of the blowers for combustion air, air compressors for the hoists, rapping hammers, squeezers and burner atomizers. This plant should be in a separate room by itself, the machinery being laid out on the unit system. 'By "unit system' I mean that individual motor-driven fan blowers combined with a slow speed multicylinder pump for forcing the fuel oil to the burner should be arranged. These units should be of sufficient capacity to take care of three melting furnaces and a ladle heater. The object of this unit system is that an accident to a motor or pump only involves the shut-down of a limited number of furnaces. One of the fire underwriters' requirements is also complied with, i. e., an accident to a motor or blower at the same time shuts down the oil pump, consequently there is no danger from incomplete combustion of quantities of fuel oil which without the attendant supply of oxygen generates explosive gases. Each system should be equipped with suitable shut-off valves, expansion chambers, drainage valves and by-passes, enabling the system to be drained free of oil every night.

Meters—Suitable meters should be installed in connection with each unit so that the exact amount of oil used for the melting of metal can be ascertained with fair accuracy. My plan is to connect two meters in tandem and take out the oil for the burners between the meters. The differential reading between the meters, which have been adjusted to run accurately in series, gives or indicates the true amount of oil that has been consumed in the furnaces. This differential scheme is neces-

sary, as no meter has yet been found that will accurately measure the small amount of oil burned in even three or four furnaces. It is necessary here to state that the volume of oil thrown by the pumps is passed through regulating by-pass valves back into the suction side of the pump.

As the economical operation of the foundry depends in a great measure upon the uninterrupted operation of the power plant, it is advisable to have the plant under the management of the works mechanical department and separated from the foundry influences entirely. If this is not done, the foundry people, who rarely have any interest in or experience with machinery, allow the same to run down. Temporary patching up is resorted to in order to put off the evil day, and high grade, expensive machinery quickly deteriorates through neglect. If the plant is under the control of the operating department, expert supervision and care are insured.

Air Compressor Radiators—In connection with our air compressors, of which we have several installed, we have arranged special automobile radiator cooling devices, through which the jacket water is circulated the instant the air compressor is started. When the air compressor is put out of service, the water ceases to move; the motive power being a small piston pump connected on the end of the air compressor shaft. The re-use of the water is quite an economy in itself. If city water is employed it is usually wasted into the sewer. The operator forgets to turn it on and explosions have been known to result; he forgets to shut it off and many gallons of water, that may cost 10c a thousand, are wasted. Most city water contains large quantities of lime and magnesia in solution and these coming in contact with the heated walls of the air compressor precipitate in the form of scale. This scale cuts down the radiating capacity, the air compressor overheats and the efficiency is very greatly reduced. Not only this, but due to the pressure the water in the jackets has been known to leak through the packing and get into the cylinders, causing wet air with its attendant troubles. With the closed automobile radiator system, condensed steam or rain water is used, the furring and liming-up effect is entirely avoided and the same water can be used for months with slight additions from time to time to make up for the leakage around the pump plunger, etc. It is well to state at this time that these radiators are designed properly to dissipate the amount of heat generated in the cylinders and absorbed by the water.

Other Equipment—Other desirable equipment of the up-to-date foundry includes band saws, sprue cutters, tumbling barrels, saw filing devices, sand mixers, etc., etc. These should be direct connected to individual electric motors. The initial cost may appear a little higher with this arrangement than if installed with a single motor and line shaft, but the disposition and arrangement of the several tools can be much more economically and practically proceeded with if one is not tied up to a shaft line drive. Any single machine can be run independently of the others very efficiently if the motor has been properly selected with regard to the work to be done. Such other apparatus as monorail carriers, cinder grinders and washers, magnetic separators and schemes for skimming off the ladles before pouring, etc., are available and can be selected to suit the various requiremnts.

Furnaces—In the matter of furnaces, ladle heaters, scrap recovering furnaces, etc., these should come directly under the jurisdiction of the foundry itself, but their use should be supervised and directed by the foundry engineer. Enormous savings can be effected by the intelligent handling of the same. With the old system of coke and hard coal pit furnaces, which of course, are adhered to for many kinds of production, the greatest injury done to the crucibles is from the rough handling with the tongs and the uneven heating and cooling. With the fuel oil system and tilting furnaces, which are becoming more and more popular, combined with the propagation of suitable reducing flame is a combustion chamber of sufficient volume and absolute control of temperature, this crucible loss is greatly reduced. It nevertheless calls for much thought and resourcefulness on the part of the furnace tender to produce the best results. It is here often hard to get the old time foundryman to take a real interest in these up-to-date arrangements.

One of the greatest items of loss in a brass and aluminum foundry is the shrinkage. This is occasioned in many ways. Poor system is responsible for all of them. Volatilization loss in the methods of melting is the most important. Before building our new foundry we investigated the different types of furnaces and ladle heaters on the market and found defects in all of them and therefore decided

to design our own melting equipment, continuing the use of fuel oil which we had found very satisfactory for seven or eight years.

In our furnace we employ the concentric burner, using compressed air at about 35 pounds per square inch, to pulverize to a mist the fuel oil which is supplied at about 25 pounds pressure at the nozzle. This fuel oil and atomizing air are both preheated by proper arrangements before they issue from the burner. The volume air for combustion which is supplied through a truncated nozzle surrounding the concentric portion, is maintained at about 8 ounces pressure and by valves and gates both the compressed air and fuel oil and the volume air are controlled, maintaining the "reducing flame" whether a slow or a fast fire is desired. It is very necessary to have absolute control of your combustion in order , to produce the reducing flame, otherwise at these high temperatures the oxygen of the air will combine with the free graphite carbon and other components of the crucible and furnace lining and very rapidly disintegrate the same through chemical combination, and the metal itself will suffer loss and injury through oxidation.

Ladle Heaters—Our ladle heaters, which are arranged to use the same burner, are made with a telescoping hood that is raised up when the pouring crucible is introduced and then dropped down enveloping the same. In this way the crucible is evenly heated. We find these ladle heaters very useful for getting out small batches of work, as the heat generated in them can be as high as that produced in the larger furnaces.

Conservation of Heat in Spent Gases—On visiting any foundry, one is struck with the enormous amount of apparent lost heat and energy that issue from the vents. This heat, in the form of spent gases, can be utilized for many useful purposes if proper arrangements are made in the design of the foundry to conserve them. Core ovens can be heated, as can also wash water for use in the lavatories; these are two of the most important. The preheating of air and oil is another. This, of course, involves piping and arrangements which may to some appear complicated and unnecessary, but they are nevertheless well worth taking into consideration.

Core-Making—There are a number of ingenious machines produced for the rapid production of cores. It is safe to say that many novelties will be designed in core-making machines in the next few years. I especially look for great strides in the jarring machines for the production of large and complicated cores. Much is yet to be done in the field of permanent moulds, cement patterns and the methods of gating and arranging work both on plates and on interchangeable gates. The proper selection of core oils, sands and other compounds used in the foundry is very essential and should not, as is often the case, be left to the judgment of the purchasing agent, but should be selected intelligently only after careful investigation and practical application.

Moulding Benches—Years ago we abandoned the unhandy and inefficient tub and in its place designed and installed suitable moulding tables about six feet long and two feet wide. One-half of the top of this table is perforated with 2-inch holes drilled close together, allowing the sand which is cut off the flasks to at once fall through to the storage space below. The other half of the table is not perforated and constitutes a bench on which the patterns and tools can readily be arranged. Underneath this solid part a drawer with a lock on it is supplied for the security of the moulder's tools, swabs, etc. Each bench is equipped with an air-operated rapping hammer which can either be fastened by brackets to the bench itself or can be instantly removed and secured to match plates, allowing the moulder at the bench to work either on plate work or individual patterns, as the demand for castings indicates. This rapping hammer is operated from a knee-pad actuated valve, affording the moulder free use of both hands and obviating the necessity of calling for rapping assistance from neighbors or helpers.

Moulding Machines—All up-to-date foundries have moulding machines. Choice and selection of these machines must be governed in a great measure by the nature of the work in hand. It will be found that certain machines lend themselves to interchangeability of patterns, squeezing, deep draws, shallow plate work, etc., etc., better than others. It by no means follows that because a foundry has moulding machines of one make that an entirely different type of moulding machine would not greatly affect its efficiency.

Scrap Melting Furnaces—In a manufacturing industry like the one with which I am connected, we get skeleton brass from the punch press department, borings and turnings from the machine shop in large quantities each day.

The regular practice is to run these through an efficient magnetic separator connected with a blower system which takes out the iron, paper and light particles, passing the good metal into bins. In place of selling this stuff to the junk dealer at prices depending on varying conditions, we save and separate these borings, etc., and use them in our foundry at once. The copper and red brass borings are taken to the melting floor and are used up with gates, sprues and new metal. Much of this stuff, however, is of a mixed nature and cannot be so handled; it is therefore taken to the scrap melting furnace and run into ingots. These ingots are analyzed by the chemist, who determines closely their components. These ingots are further alloyed with pure copper and other new metals in varying proportions and first-class metal for all general purposes produced from them. We also handle in our scrap melting furnace copper wire which we get from burned out field coils, armature coils and scrap generally that is known to contain pure copper. The resultant pigs are analyzed and used as base copper for more important mixtures. The furnace is cleaned out, skeleton brass, borings, yellow brass, etc., are run off and stored for future use. With our scrap melting furnace we developed an endless chain arrangement for carrying the chills. The contents of these chills are automatically dumped into water, which cools, cleanses and softens the metal simultaneously. This system involves the continuous melting and pouring principle which we have found in practice to be preferable to the "hot bath" system where the metal is melted and tapped out into crucibles and repoured. This does not, however, indicate that the "hot bath" system is not better adapted to some other foundry requirements. A few cases of actual runs of scrap and the losses incident to the recovery of the same are as follows:

Bare Copper Wire.

Total wire melted	9054	lbs.
Total ingot recovered	8888	"
Loss or shrinkage	166	"
Loss in per cent.	1.83	%

Fine Wire.

(Includes burning off of insulation).

Total wire melted	3089	lbs.
Total ingot recovered	2773	"
Loss or shrinkage	316	"
Loss in per cent.	10.24	%

Yellow Brass Punched Scrap.

Total scrap melted	3000	lbs.
Total ingot recovered	2860	"
Loss or shrinkage	140	"
Loss in per cent	3.5	%

Aluminum—In our aluminum department for years we had been using the open flame form of reverberatory furnace and were always confronted with a heavy loss amounting often to 6¾%. Our aluminum work is of a peculiar nature—light and of an odd pattern. For every pound of casting we produced, we had to pour one pound for the runners and one pound for the riser or header. We therefore only received 33 1-3% net of the gross metal melted. The loss, therefore, had to be multiplied by three, making 20% net. We figure gross weight, because we charge so much metal to the melting floor, making a bimonthly inventory of the castings turned over to the factory and the metal in the form of ingots, sprues and risers remaining over.

We could not see any immediate relief from this loss so carried on experiments from time to time and finally decided that a tilting furnace similar to our regular crucible furnaces, but arranged with an iron kettle of the proper dimensions and shape, was the solution. With this new type of furnace we are able to handle the same number of pounds of aluminum per heat as with the old open flame furnace with a loss of only 2½% gross, as it eliminates entirely the loss due to the cutting action of the flame. In the iron kettle the flame does not touch the metal at all and while the time employed in getting out the first heat is necessarily longer, it does not materially affect the total output. Another great advantage in the kettle type of furnace is that the slag and oxide which form on the top of the pot act as a protection to the metal and the spatter, skimmings, etc., instead of being thrown into the scrap pile, are returned to the melting pot, where the globules of metal held in suspension in the slag separate from the slag and mix with the metal below, the slag itself remaining on top in the form of a protecting blanket.

In the melting of our metals such as aluminum, we employ pyrometers. We have found by using these instruments that the overheating of the metal is avoided.

A great economy results from the pre-alloying of metals. In alloying aluminum and copper, it is a well-known fact that the copper, which melts at a much higher temperature than the aluminum, must be melted first. The aluminum is then added, combines with the copper and through chemical action the temperature is liable to rise to a point that vaporizes off much of the aluminum. To rob this phenomenon of its most harmful effects, we have made a practice of compounding a rich alloy of half and half copper and aluminum, which we throw into pigs. The copper is melted first and the aluminum is added in small quantities, allowing the temperature to gradually reduce with each addition of aluminum, thus preventing overheating any considerable quantity of metal. This rich alloy, which now necessarily melts at a very much lower temperature than the original copper, is used in the final compounding of our aluminum mixture. All risk of overheating or mis-mixing large and individual batches is thus eliminated. Not only this, but the re-melting has a refining effect and a much better product is insured.

The use of fluxes, such as phosphor tin, boron, magnesium, etc., etc., is much more effectively carried out under the direction of a chemist who, as before stated, makes a special study of the action of these fluxes on the metals. I am convinced that the employment of a chemist or foundry chemical engineer in a foundry of any size soon pays a handsome dividend on his salary. As a rule the practical foundryman has too many other things to attend to in producing, to spend much time in developing.

Costs—In the matter of brass foundry costs, these must be taken up seriously and the different classes of work and styles of moulding, etc., etc., classified. Many foundries are selling their product at so much a pound, basing their prices on the cost of raw materials and their last inventory and pay roll. They really don't know what any one casting is costing them. I will mention a case that came under our observation some time ago. In our aluminum department, using what we will designate Alloy No. 48, we have a heavy production of meter cases, the moulding process making its own core. The cost of moulding per 100 pounds was $3.03, the cost of furnace tender per 100 pounds $.89, cleaning per 100 pounds $.42, making a total cost ready to deliver of $4.34 per 100 pounds. Another casting involving rather a complicated core figured the cost of the casting per 100 pounds $43.28. This shows the wide range of costs for different classes of work poured from the same alloy. Both operations were made on an up-to-date air-operated moulding machine.

In our foundry our men work on regular foundry shop orders, which are sub-divided as follows, enabling us, with the proper co-operation of the foreman and moulders, to segregate and check the different operating expenses.

We try to confine our alloys and mixtures to as few in number as possible and at the present time we have no more than fifteen to contend with. This is quite an important matter, as the fewer combinations one has to compound, the better.

Much experimentation and research work are being carried on at the present time in the advancement of the foundry art along the lines of electric furnaces and I believe that within the next few years radical changes will be incorporated, especially in foundries where electric power derived from water can be procured to heat the metals. The loss from oxidation and over-heating would then be avoided. At the present time, of course, the cost of electricity is prohibitive for this work, but I look for improvements which will make it worth while.

We read about crucibles in which a vacuum is maintained and others in which inert gases are introduced. All these refinements are the result of study by the technically educated engineer and investigator, and I fully believe that the advancement in the next ten years in the whole foundry art will eclipse that made in the last twenty, by reason of the interest taken by scientists, as above mentioned, coupled with the general work of managers and experts who see in the wave of scientific managment now overflowing the country a chance to introduce some of these refinements into their business.

The term, "Prime Western Spelter" is used to designate grades of spelter made from Western ores. Such spelter usually contains about 1% of lead. It is used for making ordinary grades of brass for rolling, for brass foundry use and for galvanizing. The best grades of rolled brass cannot be made from it on account of the amount of lead that it contains.

Nickel Alloys for Use in Electrical Resistance Work.

Some new nickel alloys for use in electrical resistance work have recently been patented by Wilbur B. Driver of East Orange, N. J., (U. S. Patent, 993,042, Mal 23, 1911). The alloys and their properties are described by the inventor as follows:

"Various alloys have been known and used for electrical resistance, having more or less high electrical resistance, but as a rule the melting-points of these alloys are comparatively low, and many of them are not stable in their electrical properties and besides are liable to deteriorate from rust, etc.

Nickel is malleable, has a high melting-point, is practically non-corrosive, and is reasonably cheap. The alloys composed of nickel and manganese alone (disregarding any other substances that may be present as impurities) have quite a high electrical resistance, but one purpose of this invention is to increase the resistance of such alloys still further. In general also, by increasing the percentage of manganese in the alloy, the electrical resistance is increased; but there is a limit to the percentage of manganese that may be employed, because too much manganese will render the alloy unworkable. On the other hand, any increase of the percentage of nickel is the same as decreasing the percentage of manganese, and the resistance is thereby reduced.

Although copper, for instance, has a far lower specific electrical resistance than nickel and manganese, yet if a small proportion of copper (or, so far as I am aware, any other similar metal or combination of metals)—one per cent or more—be added to the nickel and manganese, the resulting alloy has a higher electrical resistance than the alloy composed of nickel and manganese alone. For example, an alloy of 90 parts nickel and 10 parts manganese gives a specific resistance of about 36; if 10 parts of the nickel be displaced by 10 parts of copper, making an alloy of 80 parts nickel, 10 parts copper, and 10 parts manganese, a specific resistance of about 53 is obtained; where 20 parts of nickel are displaced by the same amount of copper, the resulting composition consisting of 70 parts nickel, 20 parts copper, and 10 parts manganese, has a specific resistance of about 60. Again, whereas a composition composed of 80 parts nickel and 20 parts manganese gives a specific resistance of about 65; I have found that the substitution of 10 parts of nickel by the same amount of copper, producing the alloy 70 parts nickel, 10 parts copper, and 20 parts manganese, gives a resistance of about 80; and an alloy consisting of 60 parts nickel, 20 parts copper, and 20 parts manganese, gives a resistance of about 90.

I am aware that alloys composed mainly of copper, with more or less manganese and a small amount of nickel, have been known and used. But these alloys are, from a physical standpoint, essentially copper alloys, that is, copper is the principal ingredient. On the other hand, my alloys are composed essentially of nickel (and manganese) in which the nickel largely predominates, to which is added a comparatively small amount of copper (or its equivalent); my alloys are not in this sense "copper alloys". My present alloys differ further from these copper alloys in having a high melting-point and in producing conductors that are stable in their electrical properties.

Improved Solution for the Electrodeposition of Soft Iron.

According to a patent recently issued to Fransz Fischer of Berlin, Germany (U. S. Patent 992,951, May 23, 1911), the following solution is capable of producing a soft and ductile deposit of iron:

Water	1 gallon
Iron Chloride (Ferrous)..	4 lbs.
Calcium Chloride	5 lbs.

It will be seen that the solution is a saturated one. The inventor recommends that it be used hot at a temperature of about 220 degrees F. The current density can be as high as 20 amperes per square decimeter, although less can be used with good results. The hotter the solution is, the more ductile the iron.

Among the uses of such electrodeposited iron, is mentioned the "steeling" or coating of copper electrotype plates in order to give them a hard surface that will resist wear.

The best form of anode hook is a V shape so that no matter what the diameter of the anode rod may be, there will always be two points of the hook that will touch it. This rule applies to any kind of anode hook.

Avoiding a Mottled Surface in Matt Dipping Aluminum.

The production of a matt surface on sheet aluminum by dipping in a hot, caustic alkali is quite extensively practiced, and it is often found that instead of a dead, matt surface one of a mottled nature forms. It may be more or less matt as the case may be, with traces of the mottled surface, or it may have a mottled appearance resembling galvanized iron. In Fig. 2 is shown such a surface.

Fig. 1. Aluminum Article Showing Dead or Matt Surface as it Should Be.

The method of matt dipping aluminum is as follows: A solution is made up of:

Water	1 gallon
Caustic Potash or Soda ...	1 lb.

The solution is used warm or hot and the aluminum dipped into it. Hydrogen gas is immediately given off from the surface, and which gradually becomes black from the iron left undissolved. After the action has taken place for some time, the aluminum is removed, rinsed in water and then dipped into a dip composed of the following:

Water	1 gallon
Nitric Acid	1 gallon

The aluminum is then rinsed in clean water and dried. If the operation is conducted properly, the surface will have a dead and uniform appearance.

The mottled appearance is produced on the surface of the aluminum by not leaving it in the potash or soda solution sufficiently long. The alkali begins to "bite" immediately and the operator is usually afraid that the surface will be too strongly attacked. After leaving it in a few seconds, he removes the piece of aluminum, rinses it and then immerses it in the acid only to find the mottled surface shown in Fig. 2.

The various stages in the action of the potash or soda are as follows:

When the action of the potash or soda has been of short duration, say a few seconds only, the surface will take on a coarsely crystalline appearance like that shown in Fig. 2. If allowed to act a little longer a finer mottled surface is produced. As the action goes on (in case sheet aluminum is used as it usually is), streaks show. These are caused by pin holes in the original cast aluminum having been elongated in rolling so as to produce streaks. After a time, these streaks become less prominent and finally, when action has been well timed, are so inconspicuous that they can scarcely be seen.

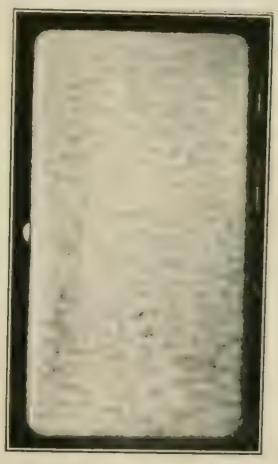


Fig. 2. The Crystallized Surface Produced by Too Short Immersion.

To obtain the best results in the production of the matt surface, the potash or soda solution should be allowed to act for some time. This serves not only to produce the desired dead appearance, but eliminates the streaks that are always present in sheet aluminum. For the guidance of the operator, let it be said that from three to five minutes are generally required in the potash or soda solution. When this has been done, the surface will have the appearance shown in Fig. 1.

Either caustic potash or caustic soda may be used in producing the matt surface. Potash works more rapidly than soda, but the ultimate effect is the same.

Experiment to Determine the Amount of Boracic Acid a Nickel Plating Solution Will Take Up.

The good effect of boracic acid in nickel plating solutions has now been thoroughly established. It was first discovered by Edward Weston, the well known manufacturer of electrical measuring instruments of Newark, N. J., and who at one time was in the nickel plating business. He not only discovered the fact that boracic acid is an excellent material in a nickel plating solution, but patented it in 1882, and the patent has long since elapsed, of course.

The advantage of boracic acid in nickel plating solutions lies in the fact that it produces a slightly acid reaction which is so beneficial. It has now been thoroughly established that to obtain satisfactory results, a nickel solution should have a slightly acid reaction. If made alkaline (either with ammonia or potash or soda which, of course liberate ammonia from the double nickel and ammonium sulphate and produce the same effect) the nickel deposit is not only dark but brittle and is apt to peel or flake off. In many instances, particularly when a strong current has been used, the nickel deposit will usually flake off in the solution in numerous small spangles. The use of a slightly acid solution, therefore, corrects this difficulty and gives a white and tough deposit. When the nickel solution is slightly acid with sulphuric acid, good results are obtained, but there is so much chance of overdoing the addition that the use of this acid is not to be recommended. It is extremely difficult to introduce just the right quantity, and as it is the strongest acid, the effect of a small quantity is very marked.

On the other hand, boracic acid is one of the weakest acids and an excess does not seem to have the marked effect that is produced by sulphuric acid. It is on this account that there has been so little information possessed in regard to the amount of boracic acid to actually use in a nickel plating solution. It has not been known whether to add a large or a small excess of this substance, and what the effect of either would be. The amount generally advocated has been from ⅛ to ¼ oz. to each gallon of the solution, and this small quantity has been employed for the reason that it has always been assumed that boracic acid dissolves in a nickel solution very sparingly, just as it does in water. In cold water it is only slightly soluble (1 part of boracic acid requires 47 parts of cold water for its solution).

In order to ascertain just what amount of boracic acid a nickel plating solution will take up, the following experiments were carried out. A nickel plating solution of the following composition was first made. This was assumed to represent the average plating solution now employed for nickel plating work:

Water	1 gallon
Double Nickel Salts	8 oz.
Single Nickel Salts	1 oz.
Sal-Ammoniac	1 oz.

The ingredients were dissolved in distilled water so as to make a clean solution and then the whole filtered through filter paper. To determine the effect of boracic acid on the solution, varying quantities were added to it and the solution boiled. *It was then allowed to cool* and the clearness of the liquid ascertained by holding it up to the light while contained in a small, white glass test-tube. If the solution was perfectly clear and showed no change, it was assumed that the boracic acid had gone into solution. The quantity of the boracic acid added each time was quite small so that the right point might be easily obtained when an excess had been introduced. When a quantity equal to 6 oz. per gallon of the nickel plating solution had been added, it was found that the boracic acid, when the solution had cooled, began to separate out in the form of minute flakes or crystals showing that the point had been reached where no more would dissolve. The result of the experiments, therefore, showed that the largest quantity of boracic acid that can be used in a nickel plating solution without having it separate out, is as follows:

Nickel Plating Solution ...	1 gallon
Boracic Acid	6 oz.

These results indicate that much more boracic acid than usually supposed can be added to a nickel plating solution without having it separate out.

(In the next issue the effect of this large amount of boracic acid on the nickel solution and the nickel deposit, as far as the actual plating operation and results are concerned, will be given.)

*Carried out in the Experimental Laboratory of *The Brass World*.

An English Apparatus for Using Lacquer Sprays.

An English apparatus for use with the spray or air-brush for applying lacquers is herewith illustrated. It is made for the purpose of saving the lacquer or other material used in the spray or air-brush. The apparatus is made by the Airostyle and Lithos, Ltd., 35 St. Bride St., London, England.

In spraying, it will be found that the lacquer sprayed on the table-top, collector, and tinplates, runs more or less in the trough in the operating table, so that, during working, a certain amount of cleaning of the collector takes place automatically. When finished with spraying, the lacquer lying on the table is scraped to the back, the little table is drawn forward, the hook in the back working table is removed, and as far as possible the lacquer lying on the perforated panels and on the solid plates is scraped into the trough. Then the operator takes out the panels, scrapes them as thoroughly as possible, and puts them in the reclaiming vat, where they should remain over night.

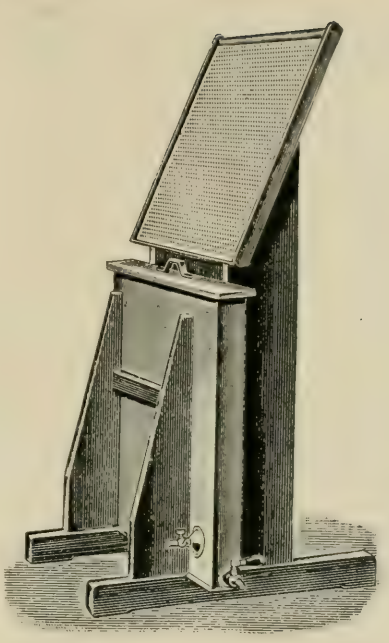


Fig. 2. Another Form of Apparatus for Saving the Lacquer.

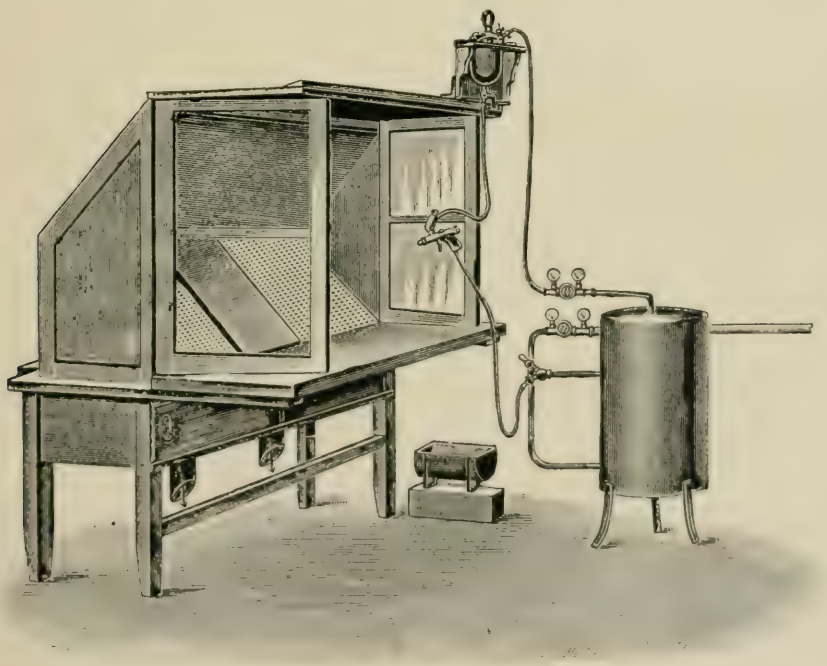


Fig. 1. The Apparatus for Using the Lacquer Spray and Saving the Lacquer.

The Pouring and Melting Points of Some High Grade Bronzes.*

By C. P. Karr.

The melting points of most of the common metals and binary alloys have been carefully studied by a number of physicists and their results have been published in the various technical periodicals. Almost all of these experiments, however, have been made in laboratories where every facility has been furnished and every condition fulfilled to make the determination adequate and conclusive. The pouring temperatures, if they have been taken in foundries in accordance with foundry conditions and every day practice have not been published so far as I can ascertain. The Bureau of Standards, Washington, D. C., has referred me to Shepherd's thermo-electric observations on brass, Jour. Phys. Chem., Vol. 8, p. 423, 1904, which are in close accord with my own, and excepting some data on casting temperatures by Percy Longmuir, referred to in Table II, and Stillman's Engineering Chemistry, early editions, but omitted from the last edition (1910), I have been unable to find any reliable data on this important question.

The experiments here described were conducted in January, this year, in the foundry of the Nathan Manufacturing Company, New York City, on the pouring temperatures of various bronzes made at their works under foundry conditions and in the course of the day's work, and without any hindrance to the regular functions of the foundry. The melting temperatures could not be taken in the foundry itself without interfering with said functions and therefore these determinations were made in the company's laboratories on four of the same type of metals from which the pouring tests, as recorded in Table I, were made.

The Fery radiation pyrometer was chosen as the instrument with which to undertake these tests rather than a thermo-junction couple plunged into the body of molten metal, because the former is better adapted to everyday foundation conditions and current practice. The temperatures stated in Table I are relative and not absolute. Owing to the rapid formation of oxides on the surface of the molten metal a large number of readings were taken as the metal was poured into the flasks with the expectation of securing a sufficient number of maximum coincident readings that should more clearly indicate the pouring temperatures than an average of all the readings taken. No claim is made for exact accuracy of the temperatures recorded because they were made hurriedly under the ordinary regular foundry conditions familiar to every expert foundryman and because of these variable oxide films and surfaces. But it is believed that the drops in the temperatures from the times of pouring from the furnace into the bull-ladles or the foundry floor respectively, to the times of pouring into the flask of a series poured, are relatively accurate. The times stated in the table were in every instance taken with a stop watch that indicated seconds on its large dial and automatically recorded minutes on its small dial.

In taking the melting temperatures in the laboratory "black body" conditions were applied as closely as possible, the metal was melted in a gas furnace supplied with compressed air. Temperatures were taken immediately after the blast was turned off, the metal stirred slowly but continuously until it cooled down to a pasty state and the pyrometer needle remained stationery for at least seven consecutive readings, this lowest consecutive coincident reading was taken as the melting point of the alloy. As the amount of copper contained in an alloy has so much bearing upon the temperature of fusion the type of the alloy is indicated in the table by its approximate percentage composition of copper.

The yellow brass used in the laboratory test was made from commercial sheet brass clippings. An analysis was made of the brass ingot after the melting test in order to determine whether it contained any constituent that would naturally lower the melting point of pure brass. It was found to contain about 68.8 per cent of copper, 0.19 per cent of lead and the balance zinc with a trace of iron. For this composition the pyrometer indicated a melting point of 1640 degs. Fahr., but on account of the heavy oxidation of the surface it is believed that this reading may be somewhat too low and particularly as the melting point of a brass containing 70 per cent of copper and 30 per cent zinc was established at about 950 degs. Cent., or 1742 degs. Fahr.,

*A paper read at the meeting of the American Brass Founders' Association, held in Pittsburgh, Pa., May 22-27, 1911.

by the examination of Haycock and Neville, the pioneer explorers in this field, although their composition contained no lead. The melting point of copper is taken to be about 1,084 degs. Cent., or 1,983 degs. Fahr. An independent reading of the No. 4 metal, not mentioned in the table, was taken in the laboratory and it showed a melting point of 1,850 degs. Fahr., a variation of 30 degs. from the figure given in the table, a variation due probably either to a state of recalescence or to some variability in its composition.

It was desired to make a comparison between the drop in temperature of metal made in a coal-fired pit furnace and the metal made in a coke-fired M. R. V. furnace. To do this all the conditions must be as nearly alike as possible. As the metal in the pit fires had to be brought from the furnace to the foundry floor in the pot in which the metal was compounded, the pyrometric readings had to be taken on the foundry floor directly from the pot itself after it was skimmed. To institute the same kind of reading with the metal from the M. R. V. furnace poured into the bull-ladle the latter had to be skimmed and read at the floor level. As the composition of the metals compared differed from one another the average copper constituent had to be about the same, and this condition was fulfilled. There were three heats in the coke-fired furnaces with six readings at the foundry floor level with an average of 1,832 degs. Fahr., and thirty-two readings at the pouring bench with an average of 1,780 degs. Fahr., or an average drop of 52 degs. There were six heats of the metal in the coal-fired furnaces with fifteen readings at the furnace floor with an average of 1,981 degs. Fahr., and fifty-one readings at the pouring bench with an average of 1,838 degs. Fahr., or an average drop of 143 degs. Fahr.

Although the mass of metal poured from the two types of furnaces was about the same in volume and notwithstanding the efforts made to equalize the mechanical conditions, it is my belief that nothing conclusive can be drawn from the comparison for these reasons:

The graphite pots of the coal-fired furnaces and the fire-clay lined bull-ladles containing the metal from the coke-fired furnaces do not have the same emissive power and their coefficients of emissivity were unknown, and secondly the metal in the coal-fired furnaces was a hydraulic metal and it was difficult to keep its surface clear in taking the maximum readings. All the readings were taken with the Tycos type of a Fery radiation pyrometer, No. 8350. Tested by the Bureau of Standards at Washington, D. C., September 14, 1910. Resistance 62.4 ohms at 22.5 degs. Cent. Calibrated for "Black Body." Telescope 6223 and used with a horizontal scale, graduated from 800 to 2,400 degs. Fahr. Mr. E. C. Taylor, of the Taylor Instrument Company, Rochester, N. Y., assisted me by taking the focus on all the metals examined.

It was hoped for but hardly to be expected that a comparison of the rates of cooling as shown in the Table I would lead to the development of a theory that could be used in a practical way to express the drop in temperature of any given bronze alloy for a stated period of time, so that knowing the initial temperature the correct pouring temperature could be deduced, but so many conditions of foundry practice were involved and so few have been the experiments made that such a law, if one there be, could not as yet be enunciated. Of course the basic metal of all bronzes is copper, and the inter-action of other metals upon copper itself and upon one another simultaneously, especially in combination with the complex formation of solid solutions and eutectic mixtures which have not been fully studied, this inter-action, so to speak, is so inseparably a part of the problem that nothing conclusive could be formulated.

To ascertain if a heat has been a good one it becomes necessary to make some well-known tests. No matter how great the skill of the foundryman may be, he cannot know that his heat has been a satisfactory one until these tests have been made. Although every other condition may be fulfilled, if the pouring temperature has not been right the heat will prove to have been unsatisfactory. The pyrometer is only a precautionary means to an end, but not a cure-all. If at the time the observations are undertaken to establish the correct pouring temperature, the pyrometer readings are concurrently taken both as a check and as a record and the trial continued consecutively for at least one week to obtain simultaneous readings and concordant results, then the standard pouring temperature may be arrived at and the real value of the pyrometer will be recognized by readings concurrent with the standards thus obtained. The fluctuations of the needle due to oxide films and slaggy surfaces must constantly be borne in

Table No. 1

Pouring and Melting Points of Some High Grade Bronzes

M.R.V. Furnace No. / Pit	Metal No.	Approximate Amount of Copper %	Temperatures at Furnace Mouth — Focus on the pouring stream of Metal		Temperatures at Foundry Floor after pot was skimmed — Focus on face of Molten Metal		Temperatures at pouring Bench from Pot to Flask — Focus on pouring stream of Metal — Maximum Reading			POURING TIME		Drop in Temperature from Temperature at Pouring Stream at Furnace Mouth to Stream from Pot	Amount of Metal Poured Per Heat	Drop per Second	Melting Point		REMARKS
										From Furnace Mouth	From Furnace Floor						
			Degs. Fahr.	No. of Readings	No. of Readings	Degrees Fahr.	No. of Readings	Degrees Fahr.	No. of Molds	Min - Sc	Min - Sc	Degrees Fahr.	Lbs.	Degrees Fahr.	No. of Readings	Deg. Fahr.	
7	1	84	1755	2			18	1700	14	5- 0		55	450	0.488	20	1650	
6	1	84	2070	2			8	1840	8	4- 4		230	450	0.942			Cooled down by gates
2	2	81	1720	4			14	1650	14	3- 0		70	450	0.436			
8	2	81	1720	2	2	1675	10	1600	23	6- 6	5- 6	170	450	0.556			Time taken from Foundry floor
5	3	69	1740	4			7	1670	10	1-55		70	450	0.608	14	1640	Yellow Brass
6	4	88	1990	2	2	1970	8	1940	5	3- 0	2-30	30	450	0.161			Time taken from Furnace floor
5	4	88	2000	4			8	1940	8	5-49		60	450	0.172	17	1820	
1	5	81			2	1850	14	1800	14		3-55	50	450	0.212			
2	5	81	1850	2			21	1800	14	3- 0		50	450	0.278			
2	5	81	1800	2			19	1735	14	6-36		65	450	0.164			
Pit	6	84			2	1900	10	1800	10		3-25	100	190	0.488			
Pit	6	84			4	1992	10	1750	10		6- 0	242	190	0.806			Cooled down by gates
Pit	6	84			3	2113	10	1890	10		5- 0	223	190	0.743			" " " "
Pit	6	84			2	2000	3	1900	9		4 50	100	190	0.345			
Pit	6	84			2	1880	9	1840	9		3- 6	40	190	0.215	22	1735	
Pit	6	84			2	2000	9	1846	10		3 40	154	190	0.700			Cooled down by gates

mind and for this reason, if for no other, the maximum readings should be the only ones resorted to as a guide for the pouring temperature, and even this should be compared with and confirmed by the melting point of the alloy in question. Said melting point to be established by some suitable laboratory method. In reference to the pouring temperatures, from a private communication received February 16 from the Bureau of Standards, Washington, D. C., whose unfailing courtesy and advice have been of such invaluable assistance to me in the conducting of these experiments and the preparation of this report, I quote:

"Your remarks regarding the uncertainty in comparing Fery readings taken under diverse conditions as to the material of the surroundings, appear to us to be very much to the point, and such uncertainties, due to varying emissivities of containers, may be very considerable. If, however, the whole crucible is hot, and the surface of the metal is well below the rim, say, half way into the depth of a crucible of twice the height of its diameter, and the metal is not skimmed, it would make a minimum difference in readings for the difference in crucibles. Perhaps by heating two half-filled crucibles of different material and same size side by side in a furnace until they attain the same temperature, and then withdrawing them and reading metal temperatures with the Fery, as above indicated, you might be able to check this matter out."

I did not have the opportunity to follow up this valuable suggestion, for it could be carried out very well with two black lead crucibles or two bull-ladles, but in comparing bull-ladle and black lead pot radiations the emissivities of the containers must be known and also that of the metals contained. Burgess has determined the emissivities of copper and cuprous oxide and their values might be introduced to arrive at the radiation of the metals as copper predominates in the alloys discussed and cuprous oxides in the oxide surfaces.

Table No. 1 to be inserted here—To be a cut.

In 1909, in an address delivered before the Metallurgical Society, of Birmingham, England, Mr. Percy Longmuir refers to the casting temperatures of some gun metal, yellow brass, red brass and Muntz metal, the best specimens registered as follows:

In the above table the No. 3 metal is a yellow brass; No. 4 metal corresponds to Mr. Longmuir's gun metal; No. 5 is of a lower grade than the other bronzes; No. 6 is a high grade hydraulic bronze and while showing a high tensile strength its elongation is small and it possesses proportionately a low percentage of reduction in area.

It has been suggested to me by an expert foundryman that the best way in which to make use of the pyrometer in the foundry for taking the pouring temperatures is to have it set up in the foundry in a suitably protected structure and bring the pot to the pyrometer instead of carrying the pyrometer around with the pot to the great confusion and disgust of the caster. With this recommendation I most heartily agree.

Liege Metal.

In the *Daily Consular Report,* Consular Assistant Bartley F. Yost of Paris, France, gives the following information in regard to "Liege-Metal", a new alloy which has appeared in that country and which is being used in the construction of air-ships. From the following analysis given, it would appear that the metal is really commercial magnesium.

An article of considerable interest to the world of aerial navigation for "heavier than air" as well as "lighter than air" craft is the new metal known as Liege metal. It is said to be 40 per cent lighter than aluminum and has a density of 1.762. Its surface is grayish-white, reflecting rays analogous to those of poorly worked aluminum. The following is its composition: Aluminum, 0.04 per cent; iron, 0.01 per cent; zinc, 0.44 per cent; sodium, 0.21 per cent; magnesium, 99.3 per cent.

Use of Lead Perchlorate in the Electrodeposition of Lead.

The Siemens & Halske company of Berlin, Germany has lately patented the use of a new electrolyte for lead refining. This electrolyt consists of a solution of lead perchlorate, containing free perchloric acid, and a colloid of some sort, glue, gelatin, etc., to prevent the lead from coming down in crystalline form. The advantage of such an electrolyte is supposed to consist in its higher conductivity, and the fact that it does not decompose on heating, as does the hydrofluosilicic acid of the Betts process.

The Severity of English Laws Respecting Brass Foundry Conditions.

The severity of English laws respecting the conditions which exist in brass foundries and casting shops, may be well appreciated from the following articles from the *Ironmongers' Chronicle*. While the bad effect of zinc oxide fumes is well known, there has been no satisfactory method of preventing their existence in the foundry. The law requires that an apparatus be used for covering the crucible while skimming and pouring so as to remove the fumes and prevent their escape into the shop. That this apparatus does not meet with the approval of the employees will be understood from the article:

On Wednesday last week, at the Wolverhampton Police Court, before Mr. N. C. A. Neville (the Stipendiary magistrate), William Carter, employee at a brassfoundry at Willenhall, and Messrs. C. and L. Hill, the employers, were summoned for neglecting the regulations for the casting of brass. Mr. K. H. Garvie prosecuted, and Mr. George Vaughan appeared for the employers. The defendants Hill kept a brassfoundry at the junction of Walsall Road and Doctor's Piece, Willenhall, and Carter was employed there as a brassfounder. Mr. Garvie said that when he visited the foundry on March 15 with another man he could not see the walls of the room for the fumes coming from the crucibles. The apparatus was efficient, but Carter was guilty of neglecting to use it, and Messrs. Hill of not enforcing its use. He did not admit that Mr. Hill had made continuous effort to get his men to use the apparatus, but allowed that the men had been spoken to by Mr. Hill.—Daniel Dunton, Doctor's Piece, foreman at the foundry, said he went round with Mr. Garvie, and both he and Mr. Garvie asked Carter to use the apparaus, which did not appear to have been used for a considerable time. The fumes were so dense that they could not see a a wall ten yards away. He said Messrs. Hill had told the men whom he found not using the apparatus that he would report them to the inspector.—Mr. Limnel Hill, a member of the firm, said he had the regulations posted up in his works, and had done everything in his power, short of actually dismissing the men, to enforce compliance with the rules. He mentioned that the men were all up in arms against the new apparatus. It was a little more trouble.—Mr. Neville: They prefer to remain unhealthy.—Mr. Vaughan contended that there was no case against the employers, as they had done all they were called upon to do under the Act to get the apparatus used, and the responsibility for the breach of the rules lay with the workmen,—Mr. Neville, addressing Carter, said it would be necessary to punish him for not taking care of his own health. It was most important that the men should take advantage of the costly apparatus provided by the masters, not only for the sake of their own health, but because it was in compliance with the law. He did not consider it a serious case against the employers, but he hoped some procedure would be taken, and not merely threats uttered.—Carter was fined 20s. and the firm 5s. and the costs.

A New Composition for Treating Electrotype Molds.

A new composition for use in treating wax molds used in electrotyping, to render them conductive, has been patented by George E. Dunton of New York City, (U. S. Patent, 993,157).

The process consists in using the following mixture for polishing the surface of the wax instead of graphite alone:

Water	1 gallon
Caustic Soda	1 oz.
Caustic Potash	1 oz.
Graphite	2 lbs.
Glycerine	4 oz.

The mixture is either brushed on or sprayed on and it is claimed to be much superior to graphite alone on account of not stopping up the fine impressions. The excess on the surface may be washed out, while ordinary electrotypers' graphite adheres too tenaciously.

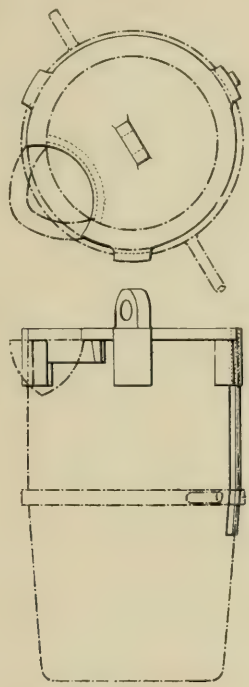
A finely powdered silver suitable for silver deposit work is obtained by precipitating a dilute solution of nitrate of silver by metallic copper. The copper precipitates the silver as a very fine metallic coating which may be filtered out and washed. This is the method used for making the silver employed in silver deposit work.

A Crucible Lid for Preventing Escape of Spelter Fumes.

A lid for use on crucibles employed in brass melting has recently been patented by William Ross and Thomas Ross of Glasgow Scotland. It is intended for preventing the escape of the oxide of zinc fumes so as to render the operation of pouring less injurious by keeping the atmosphere as free as possible. The lid may be applied to either graphite crucibles or clay crucibles (used in England).

FIG.1.

FIG.2.



The Crucible Lid.

The lid is made of iron and fits down over the top as shown, being held in place by finger pieces. An eye is fitted at the top so that the lid may be readily removed or placed on by a skimmer or other similar tool.

The use of the quickening or blue dip on German-silver preparatory to silver plating is necessary in order to prevent the ultimate stripping of the silver. It gives the German-silver a light coating of mercury which serves as a bond between this metal and the silver deposit put on. Without it, silver plated flatware would not be as lasting and serviceable as it is at the present time.

French Plates for Music Engraving.

In the *Daily Consular and Trade Report,* Consul General Frank H. Mason of Paris, France, gives the following information in regard to metal plates used for music engraving:

An inquiry comes from St. Louis asking for technical information as to the kind of plates used in Paris and France for engraving music. Investigation of this purely technical subject has involved personal inquiries at some of the leading music publishers, and the following information secured.

The plates used in France for music engraving are made in four qualities, as follows: No. 1 contains 60 per cent copper; No. 2, 46 per cent; No. 3, 35 per cent; No. 4, 20 per cent; but it was not learned with what metal or metals the copper is alloyed—probably wholly or mainly with zinc. Nos. 2 and 3 are most generally used, the latter for ordinary work, band parts, songs, etc., and the former for piano music. No. 1 is only employed for expensive work (gift books, etc.), and No. 4 for very common work. The plates are made in five sizes, viz: Opera, 20 by 27 centimeters (centimer=0.3937 inch); symphonie, 21 by 28 centimetres; grand symphonie, 22½ by 30 centimeters; partition, 24½ by 32 centimeters; and conservatoire, 26½ by 34 centimeters.

Britannia metal is little used in France and would not, I think, be suitable for music plates. Zinc has been tried, but is too hard, spoils the punches and burins, and is liable to rust.

(In the United States, a soft metal with a tin base, analagous to britannia metal is used for some classes of cheap music plates. The characters for the music are stamped in instead of being engraved—*Editor).*

In the smelting of copper bearing materials in a blast furnace, iron slag is used with limestone as the flux. It has been found that the presence of iron in the slag will serve to prevent the entrance of copper except in very small amounts (1% and under). If no iron is present in the slag, copper will enter it in a much larger quantity. In a well proportioned slag, the copper in it can be kept down from 1 to 2 per-cent.

Questions and Answers.

QUESTION No. 982. Does it spoil potassium cyanide to boil it? Some platers say that it injures it.

Answer. Potassium cyanide decomposes to a slight extent when its solution in water is boiled, but not to such a degree as to injure it. Long continued boiling, however, will gradually decompose it with the loss of cyanogen and formation of potassium carbonate. Potassium cyanate also forms upon the decomposition of potassium cyanide.

QUESTION No. 983. Is it advisable to use aluminum in all kinds of yellow brass castings? Some brass founders say they never use it and others seem to use it extensively.

Answer. While aluminum is an excellent addition to the majority of brass castings, it cannot be used in all kinds. Work to stand pressure should not have aluminum in it as it causes leakage. This applies particularly to plumbers' brass goods. Very thin castings, too, which have to be poured very hot should not contain aluminum as it causes considerable dross to find its way into the mold. For the majority of work, however, you can use aluminum to an excellent advantage as it causes the brass to run very sharp and promotes soundness. Castings which otherwise would have to be poured on end can then be poured flat. The only objection to the use of aluminum is the dross which is apt to find its way into the casting; but this can be overcome by pouring the brass as cold as possible, and not forcing it. A long runner also promotes clean castings.

QUESTION No. 984. What would you recommend for a good imitation "gun-metal" on brass?

Answer. We recommend oxidized silver as it gives good results and is extensively used. Silver the brass as usual for about half an hour, then oxidize in a hot liver of sulphur solution containing 3 oz. of liver of sulphur to the gallon. Then scratch brush while dry and lacquer with a suitable lacquer. This finish is very durable. It is extensively used in the jewelry and metal novelty trades.

QUESTION No. 986. Can steel pants buttons be blued by any other method than by heating? We desire to blue them but have no furnace for the purpose.

Answer. You can blue them by the use of 4 oz. of sugar of lead and 4 oz. of hyposulphite of soda dissolved in 1 gallon of water. It is used hot as a dip and the steel buttons dipped into it until they become blue. We cannot recommend it, however, as the blue color fades even when lacquered. The usual method of bluing steel buttons is to tumble them, to remove the burrs and smooth them, then case-harden them and afterwards tumble them to produce a smooth and polished surface. They are then blued in a special form of gas furnace which tumbles them while being heated and performs the work in practically an automatic manner.

QUESTION No. 988. We have a brass solution used for plating steel rods. These rods are 3/8 x 36 inches. We are running through 50 at a time. After leaving them in the tank ¾ of an hour they have only a slight deposit of brass and which, when buffed, is all removed. Why does it take such a length of time to obtain a brass deposit and what can be done to adjust the solution so that we can obtain a heavier and quicker deposit?

Answer. When a deposit cannot be obtained from a brass solution in a few minutes it indicates that either there is a deficiency of copper and zinc carbonates in the solution, or there is too much free cyanide in it. If the anodes remain clean and bright after some time it indicates that too much free cyanide is present. In a good brass solution the anodes do not constantly remain clean. Add some carbonate of copper and carbonate of zinc to your solution and it will not only take up the excess of free cyanide, but supply more metal that may be required. If, after this addition, the anodes coat over rapidly and the passage of the current is impeded, then it indicates that too little free cyanide is present and you will have to add a little more cyanide. Be careful not to add too much, however, or your original trouble will return.

QUESTION No. 989. Can aluminum or aluminum alloys with aluminum as the principal ingredient be cast in metal molds under pressure the same as the so-called "die-castings" are made? We have tried the aluminum and zinc alloys (with aluminum in excess) such as those employed for sand castings, but without success. What aluminum alloy has the least shrinkage and cannot it be used in die molds?

Answer. The making of aluminum castings in metal molds has not been successfully accomplished. Some simple shapes that are free to contract are made, but ordinary castings are torn apart in cooling. The aluminum alloy with the least shrinkage is one consisting of 92% aluminum and 8% copper. We fear you will not be successful in casting it, however, as it has been tried by other makers of die castings without satisfactory results.

QUESTION No. 990. In annealing sterling silver by means of a blowpipe in the open air, what is used for preventing the introduction of "fire" in the surface of the silver. I understand that the silver is coated with something which prevents the "fire".

Answer. It is customary to coat the sterling silver with a sort of paint made of yellow ochre mixed with water and a little dextrine. The dextrine, being an adhesive, holds the ochre on the surface when dry. The silver is thus given a coating of yellow ochre (which is oxide of iron mixed with more or less clay) which protects it from the air when the annealing is carried out. There are a number of other materials that can be used in place of the ochre as all that is needed is some material

that is not altered by the heat and does not act on the silver when heated.

QUESTION No. 991. Can a practically pure oxide of copper be purchased which could be used for making sulphate of copper and which would dissolve easily in sulphuric acid? We have heard that oxide of copper results as a by-product in the manufacture of copper wire and sheet. If such oxide could be obtained as a price for the copper in it which is approximately that of metallic copper, we believe it would be advantageous for us to use it for making sulphate of copper.

Answer. The material you have in mind is "copper scale" resulting from the hot rolling of copper, either in the form of sheet or wire. It is a mixture of the black oxide of copper, sub-oxide of copper and metallic copper. It will run from 70 to 85 per cent in copper, depending upon its purity. You can readily dissolve it in sulphuric acid. You will not be able to purchase this copper scale, however, at the price you imagine. It always commands a higher price than the actual copper in it, as it is used for making marine paint, galvanic batteries and for other uses. The large copper rolling mills, too, use it themselves and run it through a furnace and reduce it to metallic copper so that they have none for sale. You will not find it an advantageous material for making sulphate of copper on account of the high price you would have to pay.

QUESTION No. 992. What is a good white metal mixture for making white metal patterns?

Answer. Use the following which will give you good results. It is in use in many establishments and has been found to be very satisfactory:

Tin	7 lbs.
Lead	7 lbs.
Antimony	2 lbs.

QUESTION No. 993. We desire to use a dead black lacquer as a background for etched brass. The high-lights of the brass are to be left bright. How can the lacquer be put in the background leaving the highlights showing the brass?

Answer. You will have to apply the lacquer to the whole surface and then wipe off the high-lights. This can be accomplished by fastening a soft cloth to a flat wood block and rub off the lacquer on the high-lights with it, leaving the background untouched. A few trials will indicate to you the necessary method of doing it.

QUESTION No. 994. Should a mold be inclined or laid on the spill trough perfectly flat? I refer to small molds for casting brass and which are made on the bench. The molds are not poured "on end."

Answer. It is advisable to incline the mold slightly with the gate end raised. This allows the metal to run into the mold more readily and give the air a little better opportunity to escape. It is always customary to incline the mold in this manner as it has been found to give better results than when poured flat.

QUESTION No. 995. Can the color of "fire gilding" be changed like gold-deposited in electroplating? That is can it be altered to suit the case? The ordinary fire gilding obtained by using 24 karat gold is not the right shade and I wish to obtain different colors.

Answer. You can obtain the different gold shades in fire-gilding in the same manner as in electrogilding. By adding a small amount of copper to the gold, the color becomes redder. The addition of silver changes the color to a lemon or greenish yellow. By adding both copper and silver other shades may be produced.

QUESTION No. 996. What is the best material for making cores for valve castings plumbers' brass goods etc. I mean the binder to use.

Answer. The binder to use will depend upon your own conditions. Flour is extensively used, probably more than any other binder and is excellent if too much is not used. Many foundries now prefer a linseed oil binder and it makes a good core that will not absorb moisture on standing. It makes the core rather hard, however, and unsuited for some work. One of the best binders is molasses water as it makes a soft core and gives off but little gas. Such a core is excellent for making aluminum castings. Founders often experience trouble with cores on account of the use of poor core sand. Burnt sand, beach sand and similar sands, which do not contain any matter that will burn out and produce gas, are excellent.

QUESTION No. 997. What is the theory of the use of the so-called conducting salts in plating solutions?

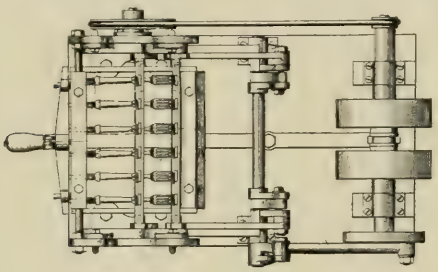
Answer. Conducting salts are used in plating solutions in order to increase the electrical conductivity. They are used in solutions which lack conductivity. When such conducting salts are employed, they allow a greater quantity of current (amperage) to pass through the solution in a given time. This means that a greater quantity of metal is deposited in a given time. If, for example, 10 amperes of current pass through the solution before the conducting salts are added, and 30 amperes pass when the conducting salts have been used, then 3 times the amount of metal is deposited per minute. Conducting salts are usually of such a nature that they do not affect the deposit nor attack the anode. In fact, they only increase the electrical conductivity of the solution.

QUESTION No. 998. Can pure copper castings be made that will have a high electrical conductivity and cut readily without dragging or clogging the tool when threaded or otherwise machined?

Answer. You will not be able to accomplish this. In order to obtain a free cutting quality it will be necessary to add quite an amount of some hardening metal like tin. This will not only reduce the conductivity but alter the color. In order to have the high electrical conductivity you must have practically pure copper which is, by nature, soft and tough.

Patent Abstracts.

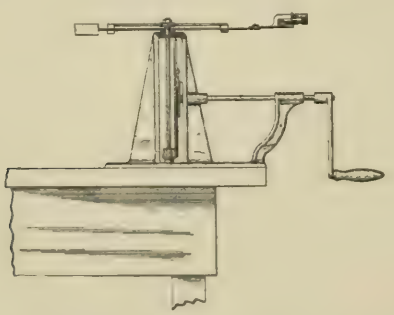
990,257—990,258 & 990,259, Apr. 25, 1911. BURNISHING MACHINE. C. W. Hammond of Rockford, Ill. Assignor to the Rockford Silver Plate Co. of the same place. Machines for burnishing silver-plated knives, forks and spoons. The novelty of the machine lies in the manner of holding the work, the



method of forcing the burnishing tool over the surface of the plated article, and the feeding device. Reference to the drawings of the specifications will be necessary in order to fully understand the method employed. The machines are, of course, intended for replacing hand burnishing.

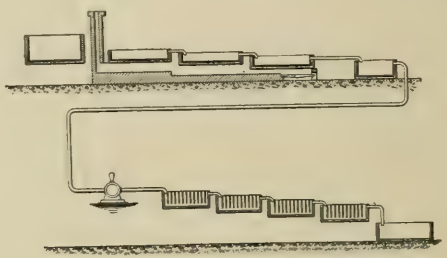
993,116, May 23, 1911. PROCESS OF MANUFACTURING METAL TUBES. Otto Archibald Simpson, of Charlottenburg, Germany. Assignor to Siemens & Halske A. G., Berlin, Germany. A process for making seamless tubing of tantalum. A recess is made in a rod of tantalum, a soft core inserted and the whole rolled, after which the core is withdrawn.

990,816, Apr. 25, 1911. CASTING APPARATUS. Alexander Jameson of Indianapolis, Ind. A device for casting small quantities of metal by centrifugal motion. The



metal is melted in the mold at one end of an arm and which is then rapidly rotated by a crank, turned by hand.

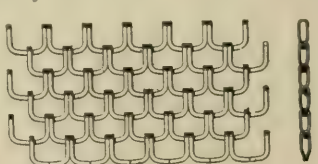
991,685, May 9, 1911. PROCESS AND APPARATUS FOR PURIFYING ACID ELECTROLYTE USE IN REFINING COPPER. Charles H. Aldrich and John K. Bryan of Perth Amboy, N. J. A method for removing the arsenic, antimony, iron and other impurities in the sulphate of copper used as the electrolyte employed in electro-



lytic copper refining. Th electrolyte, previously concentrated, is passed through a cascade series of cast-iron pans and crystalization carried out. The crystals in the first pan are rich in copper while those in the last contain some nickel. The liquor left is now run into a tank and the antimony and arsenic precipitated on a cathode electrolytically.

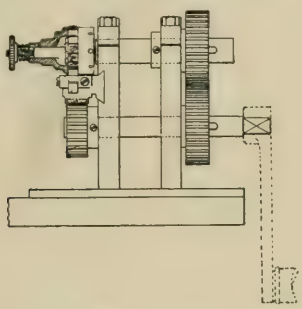
992,423, May 16, 1911. PROCESS OF PRODUCING TITANIUM ALLOYS. John B. Huffard of Glen Ferris, W. Va. Assignor to the Electrometallurgical Co. of New York City. The process is applied more particularly to the alloying of titanium and vanadium. It is stated that the two metals cannot be alloyed directly as the heat necessary to melt them volatilizes the vanadium. The method employed is to treat vanadium oxide with metallic titanium when a reaction occurs, the oxide is reduced to metallic vanadium, which alloys with the titanium.

990,253, Apr. 25, 1911. SILVERSMITH'S STOCK. Marcus T. Goldsmith of Newark, N. J. A stock material for silversmiths' use. The novelty lies in the manner of making it



and it is intended for the manufacture of mesh bags or similar articles. The illustration shows the method of forming the links.

990,912, May 2, 1911. APPARATUS FOR ENGRAVING THE INTERIOR SURFACES OF HOLLOW ARTICLES. Konrad Schwann of Hanau, Germany. The hollow article to be engraved is pushed over a roller

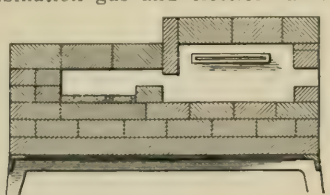


carrying on its outer surface a matrix of the required design, and then rolling the article with this roller. The manner of carrying out the process may be understood by referring to the illustration.

992,288, May 16, 1911. MOLD FOR TWYERS AND OTHER HOLLOW ARTICLES. A mold for molding blast furnace twyers which does not require a drag in making the mold, and also special means for adjusting the core.

992,227, May 16, 1911. BUFFING BRUSH FOR BRONZING, GILDING AND THE LIKE. Bernard McGinty of Doylestown, Pa. A device for use in bronzing or gilding with powdered metals. It is to be used more particularly for rubbing in the bronze powder on article to which it is applied.

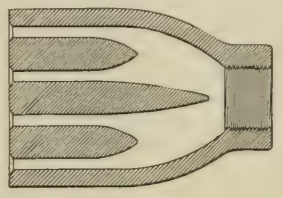
991,929, May 9, 1911. FURNACE. Thaddeus F. Bailey of Alliance, Ohio, Assignor to the Electric Furnace Co., of the same place. A combination gas and electric furnace. The



gas is used to heat the furnace up to the maximum temperature possible by this fuel, and then the electric current is employed to obtain the desired higher temperature.

990,470, Apr. 25, 1911. MACHINE FOR COVERING STRIPS OF WOOD WITH METAL. Andrew Beyrle of Los Angeles, Cal. A machine for covering stripes of wood with sheet metal and which are then to be used in the manufacture of fireproof doors, windows or other similar building material.

990,409, Ppr. 25, 1911. SAND-BLASTING NOZZLE. John P. Walsh of Boston, Mass. A sand-blast nozzle with a number of dis-

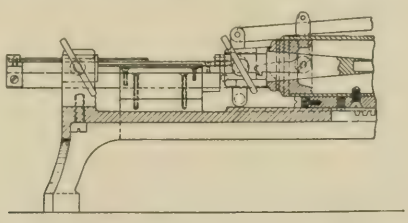


chage openings so that the surface treated may large. With one opening in the nozzle, the surface acted upon is necessarily limited.

992,698, May 16, 1011. METHOD FOR THE PRODUCTION OF DENSE SILICON CARBIDE (CARBORUNDUM). Frank J. Tone of Niagara Falls, N. Y. Assignor to the Carborundum Co., of the same place. Shaped pieces of silicon carbide and molded carbon are placed against one another and heated in an electric furnace. The vapors of silicon from the carbide penetrate the carbon at such a high temperature and form a dense silicon carbide again.

991,953, May 9, 1911. KNIFE. Henry E. Chandler of New York. A table knife of the ordinary shape, but with the edge slightly indented near the tip for a fraction of an inch. It is claimed that the cutting power of the knife is thus greatly increased without need of sharpening.

990,302, Apr. 25, 1911. APPARATUS FOR MEASURING TENSILE AND BREAKING STRENGTH. Louis Schopper of Leipzig, Germany. The object of the invention is



to enable one to obtain the tensile strength and elongation in one operation more rapid and simple than heretofore.

992,621, May 16, 1911. CENTRIFUGAL DRYER. John M. White of Mapleton Depot, Pa. A centrifugal machine for use in drying sand or similar materials. The drier is cylindrical and horizontal, and the sand is fed into one end. When dry it escapes through a screen in the periphery of the machine.

Trade Items.

The Richmond Lamp Mfg. Co., Richmond, Ind., has been incorporated with a capital stock of $50,000 to manufacture carriage and automobile lamps.

The English & Mersick Co., Winchester Ave., New Haven, Conn., manufacturers of carriage and automobile hardware, have now commenced the manufacture of automobile radiators.

The brass foundry of the Westport Brass Foundry Company in Westport, Conn., has been closed and the equipment sold. This foundry had been in existence for several years and a jobbing business was carried on.

Tiffany & Co., the well known jewelers of New York City, with works at Forest Hill, Newark, N. J., are now refining their own platinum scrap and wastes, having recently installed a complete plant for this purpose.

The Western Clock Co., of La Salle, Ill., clock manufacturers, are now operating two die casting machines which are used for casting a metal hub of soft metal upon a clock wheel. One operator handles a machine and turns out from 3,500 to 5,500 complete and finished pieces per day. This company are also using considerable sheet zinc in the manufacture of clocks, taking the place of sheet brass ordinarily employed.

The Opal Chemical Co., 126-128 Gotthardt St., Newark, N. J., are now manufacturing the celebrated "Por-Cel-O" lacquers, lacquer varnishes, bronzing liquids and electric lamp dips in all colors. These lacquers have been given a thorough trial on the market and have proved to be exceptionally satisfactory. They are made with the extreme care so necessary in the manufacture of the highst grade of goods, and no pains have been spared in obtaining the highest class raw materials which enter into the composition. Correspondence is solicited on the subject of lacquers and information will cheerfully be given. This company are also making a line of excellent metal polishes.

At the meeting of the American Brass Founders' Association, held in Pittsburg, Pa., May 23-26, the following officers were elected: President, L. W. Olsen, superintendent of the Ohio Brass Co., Mansfield, Ohio; vice-presidents, John F. Thompson of the Orford Copper Co., Bayonne, N. J.; R. T. Roberts, National Brass & Copper Tube Co., of Hastings, N. Y.; P. T. Augenbraun, Yale & Towne Mfg. Co., Stamford, Conn.; G. H. Clamer, Ajax Metal Co., Philadelphia, Pa.; Philip Mueller, H. Mueller Mfg. Co., Decatur, Ill.; R. C. Faunt, Faunt Bros., Chicago, Ill.; H. W. Gillett, Aluminum Castings Co., Detroit, Mich.; John C. Sharp, Sharp Brass Works, Chattanooga, Tenn.; N. K. B. Patch, Lumen Bearing Co., Toronto, Canada; R. R. Mitchell, the Robert Mitchell Co., Ltd., Montreal, Canada.

The Buffalo Standard Mfg. Co., has been corporated in Buffalo, N. Y., to manufacture hardware specialties. A factory has been started at 77 Washington St.

The Model Brass Casting Company, 36 Lounsbury St., Waterbury, Conn., jobbing brass founders, have closed their foundry indefinitely and business will not be resumed for the present.

The Adams & Westlake Co., of Chicago, Ill., and Philadelphia, Pa., manufacturers of car and ship hardware, brass beds and also brass founders and electroplaters, have purchased property at 22d and Ontario Sts., in Philadelphia, Pa., and will erect a new plant upon it. Plans are now in preparation.

The Art Brass & Fixture Mfg. Co., has been organized in Pittsburg, Pa. and has taken over the plant of the Star Enameling & Stamping Co., at McKees Rocks, Pa. A brass foundry and brass working plant is to be started. The new company has been capitilized at $100,000 and it is expected that operations will be commenced by July 1st. L. M. Fluhart of Conneaut, Ohio is the president and general manager of the plant. L. R. Jefford is the secretary and treasurer.

The John R. Baynes Company has been organized in Milford, Conn., for the purpose of doing jobbing etching for the trade. A factory has been obtained in that town and is already fitted up and business is being carried on. This company has been organized by John R. Baynes of Bridgeport, Conn., the expert etcher, and all work will be done under his supervision. A specialty will be made of deep etched work and piercing, and nothing but the highest grade of work will be turned out. Mr. Baynes has already earned an enviable reputation as an etcher and has already done some excellent work in this line. The company is prepared to etch all kinds of metals from sheet iron to gold.

The Comptroller of Patents for Great Britain has recently handed down a decision in regard to the "Coslettizing" patents of the Coslett Anti-Rust Syndicate of Birmingham, England, which has been gratifying to the company. The Coslett Syndicate opposed the granting of a patent to W. E. Bullock and James Calcott upon a process for rust proofing, upon the ground that the process had already been covered by the Coslett patents. The Comptroller said in his decision, that the applicants took the Coslett patent bodily and added to it an operation that might or might not be useful, and that the applicants claim clearly reclaimed the Coslett process. Costs were awarded to the Coslett Syndicate. It may be of interest to state that the applicants for the new patent, took the Coslett solution bodily and passed an electric current through it while the work to be treated was immersed in it.

J. B. Wise of Watertown, N. Y., the well known manufacturer of plumbers' brass goods, states that the item recently published in some of the trade papers in regard to his starting a brass rolling mill is incorrect as he has no intention of doing so.

The South Bend Chandelier Co., has been incorporated in South Bend, Ind., with a capital stock of $8,500 to manufacture chandeliers and other art metal goods. The incorporators are Albert Listenberger, Louis P. Teuscher and Adam S. Teuscher.

The Whitin Machine Co., Whitinsville, Mass., manufacturers of textile machinery, are erecting an addition to their foundry 200x500 feet. While the greater portion of this addition will be devoted to the iron foundry, a portion will be given to a new brass foundry. The manufacture of all the castings used by the company will then be undertaken.

The New York office of Herman Kohlbusch Sr., manufacturer of fine scales and balances, has been moved to 170 Broadway, in that city. The factory is located in Jersey City, N. J. He is the only manufacturer of solder testing scales in the United States and by means of which it is possible to accurately estimate the percentage of tin and lead in a sample of solder with great rapidity.

James N. Morehouse of Newark, N. J., who formerly operated the Newark Brass Plate Engraving Co., on Lawrence St., in that city, has now started a new company in connection with Frank C. Dalton and will carry on first class jobbing plating of all kinds. The plant is located at 34 Mechanic St., and the new firm is known as the Morehouse-Dalton Company.

The Wright Chemical Co., 38 Park Row, New York City, and with works at Kenilworth, N. J., are extensive manufacturers of nitro-cellulose lacquers and all their kindred products. They make a line of lacquers adapted for the various kinds of work upon which lacquer is necessary. They also manufacture nitrated cotton and collodion for the trade. Amyl-acetate and fusel-oil are likewise products of the company, and when in need of anything in this line, consumers should correspond with them.

The meeting of the American Brass Founders Association, held in Pittsburg, Pa., on May 3-26, together with the American Foundrymens' Association and the Foundry & Machine Exhibition Co., was the most successful and largest attended of any yet held. The exhibition proved to be what was expected of it and served to instruct foundrymen upon the latest appliances and products used in the foundry trade. New machines for molding and new foundry supplies and equipment were shown and this manner of exhibiting goods has proved to be very satisfactory on acount of the fact that the exhibit was, in many instances, a working one. The next meeting will be held in Buffalo, N. Y., and it is expected that the following year will find Boston as the place of meeting.

The office of the Leddell-Bigelow Company, manufacturers of metals and alloys, has been moved to 30 Church St., New York City. This company makes a specialty of alloys for die casting.

The Corcoran Lamp Co., of Cincinnati, Ohio, manufacturers of carriage lamps, is revising their plans for the new factory to be built by them. This factory will be 72x92 feet and four stories high.

The Monarch Engineering & Mfg. Co. of Baltimore, Md., makers of the "Steele-Harvey" oil melting furnace, had an extensive working exhibit at the Foundrymens' Convention in Pittsburgh. A full line of their products were displayed and the company was represented by D. R. Steele and H .D. Harvey.

The Jonathan Bartley Crucible Co., of Trenton, N. J., manufacturers of graphite crucibles and graphite products, had an extensive exhibit at the Foundrymen's Convention in Pittsburgh, S. H. Dougherty, L. T. Ward, H. D. Cole and Lewis L. Lawton, the secretary of the company, were all present at the convention.

The Oriental Metal Bed Co., of Hoboken, N. J., manufacturers of brass beds, has awarded the contract for a new plant to be erected on Clinton St., between 8th. and 9th. Sts., in that city. The new building will be 60x200 feet and the cost, including equipment, will be about $30,000. When completed, the company will move all their machinery to the new plant.

Wm. H. Flavin & Co., 247-249 Center St., New York City, are now carrying a full line of plating and polishing supplies for the trade. They stock buffs, brushes, rouge, tripoli, polishing compositions etc. They also handle motors and dynamos. Later, they will commence the manufacture of the supplies and equipment and are now carrying on a jobbing trade.

The Titanium Alloy Company of Niagara Falls, N. Y., manufacturers of titanium alloys, advise that up to the present time they have not placed an alloy of copper and titanium on the market. They say: We have found the article extremely hard to produce. We are working on the matter, however, and expect, within a short time, to put the alloy on the market.

The Eureka Pneumatic Spray Co., 276 Spring St., New York City, are sending out a circular to the trade announcing that they are reducing the price of their colored pigment lacquer or the so-called "lacquer enamel". This concern claims that their lacquer enamels are far superior to any yet made and that they do not have the objectionable odor of other materials. They also make the claim that their lacquers are tougher and will take a higher polish than others. They are now packing their goods in tin cans only which renders them very easily shaken and used. Their lacquers have a high flash point which renders them free from danger.

The Kelsey-Herbert Co., 570 Kirby Ave., West, Detroit, Mich., manufacturers of cane heads, fancy metal goods, and metal novelties, have increased their capital stock from $100,000 to $200,000 in order to enlarge their plant.

The Remy Electric Co., of Anderson, Ind., have purchased the interests and patents of the American Electric Headlight Co., of Indianapolis, Ind., and will consolidate it with their own plant. The Remy Electric Co., manufacture automobile magnetos.

The Lumen Bearing Co., of Buffalo, N. Y., manufacturers of bearing metals, have just issued a small folder on copper. This is entitled "Treatise One" and a history of copper is given in it. It will be sent to those who desire it.

The Aluminum & Metal Specialty Mfg., Co., of Newark, N. J., have moved to 46 Oliver St., in that city. This company was recently formed to manufacture metal novelties and specialties and has been located at 24 Mechanic St.

The Eastern Chemical & Metallurgical Co. has been incorporated at Bayonne, N. J., with a capital stock of $750,000 to carry on a smelting business and the manufacture of chemicals. Chas. H. Silliman, Walter M. Yeager and Benjamin C. Harvey are the incorporators.

The Joseph Dixon Crucible Co. of Jersey City, N. J., had their usual extensive exhibit at the Foundrymens' Convention in Pittsburgh. Dudley A. Johnson had charge of the exhibit, and F. R. Brandon, A. L. Haasis, Frank Krug and John R. Condit represented the company.

The Board of Trade of St. Catherines, Ont., Canada, have voted to give the Yale & Towne Mfg. Co., of Stamford, Conn., exemption from taxation for a term of years when they have established their new plant in that city. This company decided to locate in this city on account of the available electric power that can be obtained from Niagara Falls a short distance away.

The J. W. Paxson Company of Philadelphia, Pa., the well known manufacturers of foundry supplies, are completing a new factory building, covering an area of 9,000 square feet. Machinery is to be installed for the manufacture of steel, brass and galvanized foundry riddles. Wire brushes and brooms are also to be manufactured and the wire cloth for the riddles woven. The new building is entirely separate from the machine shop.

The Westmacott Gas Furnace Co., 9 Codding St., Providence, R. I., manufacturers of gas furnaces of every description, have just issued a new and extensive catalogue which they are sending out to the trade. It contains 64 pages and all the furnaces and other products manufactured by the company are listed in it. The catalogue contains a large number of illustrations and will be found of much interest to those to carry on melting, annealing or other operations in which heat is required.

The Queen City Ring Mfg., Co., of Buffalo, N. Y., manufacturers of gold rings, are to build an addition to their factory.

A new factory is to be built by the Hancock Mfg., Co., of Charlotte, Mich., manufacturers of lubricators and brass steam specialties.

The Zenith Carbureter Co., is preparing to manufacture automobile carbureters at 97 East Congress St., Detroit, Mich., and expect to install a complete equipment for brass finishing

The nickel plating plant of J. R. Wotherspoon, manufacturer of gas stoves at 240 North Front St., Philadelphia, Pa., was practically destroyed by fire on May 4th. Repairs have been made.

G. Klein & Son have purchased the plant of John M. Howard, 80 Clifford St., Providence, R. I., manufacture of gold and silver plated ecclesiastical goods and will continue with the business as heretofore with Mr. Howard as general manager.

The Artistic Bronze Co., of South Norwalk, Conn., manufacturers of cabinet hardware, are to move to Bridgeport, Conn., where a larger plant is to be obtained. This company operates a brass foundry and carry on electroplating and brass finishing.

The General Brass Mfg. Co., and Somerville, Ltd., manufacturers of plumbers' brass goods, and both located in Toronto, Canada, have been merged into a new concern called the United Brass & Lead Company with a capital stock of $500,000. The products of the company will remain the same.

The brass foundry of the Canada Car & Foundry Co., at Amherst, Nova Scotia, was destroyed by fire on Apr. 27th. Practically all the remainder of the plant was also destroyed and fully 800 hands thrown out of employment. This plant was formerly the one operated by Rhodes, Curry & Co.

The Lumen Bearing Co., of Buffalo, N. Y. have absorbed the Robson Smelting Company of that city, scrap metal smelters and refiners, and which will be incorporated with their own company. The Robson Smelting Co., have made a specialty of babbitt-metals, solders and similar white metals.

The recent incorporation of the Connecticut Brass Co., of West Cheshire, Conn., manufacturers of rolled brass, has not changed the business of the company in any way. The change has been one of name and the product and the officers of the company remain the same.

The Porceliron Stove Co., has been organized in Beaver Falls, Pa., with a capital stock of $25,000 and will manufacture a line of gas and oil stoves and ranges. They will be made from cast iron and a new material called "Porceliron" which is wrought iron treated with porcelain by a special process. It is stated that it is made particularly to resist breakage. Several patents are now pending upon the process, and the products, it is said, has the strength of wrought iron and the appearance of porcelain.

The Acme Brass Foundry Co., has been incorporated in Los Angeles, Cal., with a capital stock of $30,000, by F. K. Czerniski, S. F. Margozewitz, and N. C. Christensen Jr.

The American Stoker Co., 11 Broadway, New York City, are sending outa new catalogue to the trade describing their soft coal furnaces for annealing etc.

The N. Barstow Co., 7 Beverly St., Providence, R .I., manufacturers of jewelry novelties, have awarded the contract for the construction of a new factory.

The Portland Mfg. Co., of Portland, Mich., manufacturers of washing machines, are erecting a brass foundry 40x60 feet in connection with their plant. Molding machines have been installed.

The Chicago Art Metal Co. of Chicago, Ill., manufacturers of art metal novelties such as monograms etc., have moved to 302 West Lake St., where larger quarters have been obtained.

The Plume & Atwood Mfg., Co., of Waterbury and Thomaston, Conn., manufacturers of rolled brass, wire and rod, and an extensive line of manufactured brass goods, are adding a new machine shop to their Waterbury plant.

The J. W. Paxson Company of Philadelphia, Pa., manufacturers of foundry supplies and equipment, had their usual extensive and instructive exhibit at the Foundrymens' Convention in Pittsburgh.

W. F. Main, manufacturing jeweler of Iowa City, Ia., has gone into bankruptcy. The liabilities are about $75,000. He was formerly proprietor of the Puritan Mfg. Co., and succeeded it. The Equitable Mfg. Co. was also a former concern operated by him.

At the Foundrymens' Convention in Pittsburgh, the Rockwell Furnace Co. of New York City, had an exhibit of their "Centric" pouring crucible furnace and the company was represented by W. S. Quigley, F. S. Garrett, A. W. Moyer and S. L. Barnes.

Plans for the new plant of the Taylor & Boggis Foundry Company of Cleveland, Ohio have been completed and when finished, the plant will be an extensive one. Builders hardware is manufactured by the company and an extensive line of household and general hardware is likewise made.

The Dominion Metals Co., Ltd. of Toronto, Canada has secured a site in Welland, Ont., and will build a new plant on it. The smelting of gold and silver materials, sweeps and the refining of god and silver is carried on. John N. Lake is the president of the company. A modern plant is to be erected.

The National Carbon Co., of Cleveland, Ohio, are sending out to the trade an interesting and useful book entitled "Practical Operation of Arc Lamps." This book contains extensive information upon the installation and care of arc lamps, as well as other useful data. The book is 4x6 inches and cloth bound in cloth. It contains 75 pages.

The Union Art Metal Works have started in business at 171 Cooper St., Trenton, N. J.

An addition to the plant of the Southwark Plating Co., 15th, and Washington Sts., Philadelphia, Pa., is to be made.

The Benedict Mfg. Co., of East Syracuse, N. Y., manufacturers of art metal novelties, are to build extensive additions to their plant.

The Crescent Mfg. Co. has been organized in Bristol, Conn., to manufacture light hardware.

The Parkhurst Die Casting Machine Co., has been organized in Anderson, Ind., with a capital stock of $100,000.

The Seaton Crafts Co., of Lakewood, N. J., manufacturers of hand made silver goods, have closed their shop.

The Standard Art Metal Works, 60 Union St., Newark, N. J., are now manufacturing a line of belt buckles and similar art metal novelties.

The Canada Cycle & Motor Co., Ltd., of Toronto, Canada, has been absorbed by a new concern called the Russell Motor Car Co., Ltd., and the capital stock has been increased from $800,000 to $1,600,000 for this purpose.

The Vesta Gas Range & Mfg. Co., of Chattanooga, Tenn., has purchased the plant of the Chattanooga Stove Works in that city and will equip it for the manufacture of a large line of gas ranges, stoves and cookers.

Some new equipment is being installed in the Brighton works of the Keystone Bronze Co., of Pittsburg, Pa. This plant was formerly the Brighton Brass & Bronze Co., and is located at Brighton, Pa.

The Homer Brass Works, Water and Mifflin Sts., Philadelphia, Pa., was badly damaged by fire on May 3rd., but the brass foundry was not damaged to the extent of the machine shop. The equipment is being replaced.

The Johnson Coin Lock Co., has been incorporated in Columbus, Ohio with a capital stock of $25,000 to manufacture coin locks etc. The incorporators are S. M. Conby, H. Milles, W. M. Huffman, M. R. Thornton and Barton Griffith.

The August Buermann Mfg. Co., has been organized in Newark, N. J., with a capital stock of $200,000 to take over the business formerly conducted by August Buermann 220 Jelliffe Ave. The manufacture of hardware is carried on and a brass foundry operated.

The machinery and equipment of the National Brass & Iron Co., of Reading, Pa., manufacturers of lamps and ornamental goods, are being sold. The company recently went out of business and the plant is being dismantled.

The Hubbard & Jopson Co., has been formed to take over the Connecticut Novelty Co., of Meriden, Conn. The manufacture of wood and metal novelties is being carried on and a factory has been started at 2 Billard St.

Current Metal and Supply Prices.

These Prices are net and are for moderate quantities. Smaller quantities command higher prices. Prices subject to fluctuation.

Acetone, pure, 98-99%	lb.	.22
Acid, Acetic, pure, 30%	lb.	.07
Acid, Arsenious (White Arsenic)	lb.	.20
Acid, Benzoic	lb.	.55
Acid, Boracic (Boric), pure	lb.	.12
Acid, Hydrochloric, see Acid, Muriatic.		
Acid, Hydrofluoric, 30%	lb.	.04
Acid, Hydrofluoric, 50%	lb.	.10
Acid, Muriatic, 20°	lb.	.02
Acid, Muriatic, c. p., 20°	lb.	.07
Acid, Nitric, 38°	lb.	.05⅝
Acid, Nitric, 40°	lb.	.05⅞
Acid, Nitric, 42°	lb.	.06¼
Acid, Nitric, c. p.	lb.	.08
Acid, Sulphuric, 66°	lb.	.01¾
Acid, Sulphuric, c. p.	lb.	.06
Alcohol, Wood	gal.	.50
Alcohol, Denatured	gal.	.55
Alum	lb.	.04
Ammonium Sulphate	lb.	.07
Aluminum, Metallic, in Ingots	lb.	.20½
Aqua-Fortis, see Acid, Nitric.		
Ammonia Water (Aqua-Ammonia), 20°	lb.	.04¾
Ammonia Water (Aqua-Ammonia), 26°	lb.	.06¼
Ammonia Water, c. p.	lb.	.08
Ammonium Carbonate, lump	lb.	.15
Ammonium Chloride (Sal-Ammoniac)	lb.	.12
Ammonium Hydrosulphuret	lb.	.30
Ammonium Sulphate	lb.	.07
Ammonium Suphocyanate	lb.	.50
Amyl Acetate	gal.	2.75
Antimony	lb.	.09½
Arsenic, Metallic	lb.	.15
Arsenic, White (Acid Arsenious)	lb.	.20
Argols, White (Cream of Tartar)	lb.	.31
Asphaltum, Commercial	lb.	.05
Asphaltum, Egyptian (Bitumen)	lb.	.30
Benzine	gal.	.15
Benzol, Pure	gal.	.75
Bismuth, Metallic	lb.	2.00
Bitumen, see Asphaltum.		
Blue-Vitriol, see Copper Sulphate.		
Borax, Crystals or Powdered	lb.	.10
Borax Glass	lb.	.35
Cadmium, Metallic	lb.	.75
Carbon Bisulphide	lb.	.10
Calcium Carbonate (Precipitated Chalk)	lb	.10
Chrome-Green	lb.	.50
Copper, Lake, (carload)	lb.	.12½
Copper, Lake, (cask)	lb.	.13
Copper, Electrolytic, (carload)	lb.	.12¼
Copper, Electrolytic, (cask)	lb.	.12½
Copper, Casting, (carload)	lb.	.12⅛
Copper, Casting, (cask)	lb.	.12⅜
Copper Acetate (Verdigris)	lb.	.35
Copper Carbonate, dry	lb.	.25
Copper Sulphate (Blue-Stone)	lb.	.09
Copperas, see Iron Sulphate.		
Corrosive Sublimate, see Mercury Bichloride.		
Cream-Tartar, see Potassium Bitartarate.		
Cryolite	lb.	.12
Cyanide, see Potassium Cyanide.		
Dextrin	lb.	.15
Emery Flour	lb.	.04
Emery, F F & F F F	lb.	.03
Flint, powdered	lb.	.01
Fluor-Spar	lb.	.01¼
Fusel-Oil	gal.	2.75
Gold Chloride	dwt.	.60
Gum Copal	lb.	.30
Gum Guiacum	lb.	.26
Gum Mastic	lb.	.70
Gum Sandarac	lb.	.35
Gum Shellac, brown	lb.	.50
Gum Shellac, white	lb.	.60
Iron Perchloride	lb.	.25
Iron Sulphate (Copperas)	lb.	.05
Lead Acetate (Sugar of Lead)	lb.	.15
Lead, Pig	lb.	.04½
Lead, Red	lb.	.12
Lead, Yellow Oxide (Litharge)	lb.	.12
Liver of Sulphur, see Potassium Sulphide.		
Manganese, Ferro, 80%	lb.	.10
Manganese, Metallic, pure	lb.	.75
Magnesium, Metallic	lb.	1.50
Mercury Bichloride (Corrosive Sublimate)	lb.	.93
Mercury, Metallic (Quicksilver)	lb.	.43
Mercury Nitrate	lb.	1.50
Mercury Oxide, yellow	lb.	1.80
Nickel and Ammonium Sulphate (Double Salts)	lb.	.16
Nickel Carbonate, dry	lb.	.60
Nickel Chloride	lb.	.50
Nickel Metallic	lb.	.45
Nickel Sulphate (Single Salts)	lb.	.25
Nitre (Saltpetre), see Potassium Nitrate.		
Oil of Vitriol, see Acid, Sulphuric.		
Paraffine	lb.	.15
Phosphorus, yellow	lb.	.40
Phosphorus, red	lb.	1.10
Pitch	lb.	.05
Plaster of Paris, Dental	bbl.	4.00
Platinum Chloride	oz.	25.00
Platinum Metallic	oz.	44.50
Potash-by-Alcohol, in sticks	lb.	.50
Potash, Caustic (Potassium Hydrate)	lb.	.08
Potassium Bichromate	lb.	.14
Potassium Bitartarate (Cream of Tartar)	lb.	.31
Potassium Carbonate (Pearlash)	lb.	.10
Potassium Chlorate	lb.	.15
Potassium Cyanide	lb.	.25
Potassium Iodide	lb.	2.25
Potassium Nitrate (Nitre or Saltpetre)	lb.	.10
Potassium Permanganate	lb.	.17
Potassium, Red Prussiate	lb.	.60
Potassium, Yellow Prussiate	lb.	.24
Potassium Sulphide (Liver of Sulphur)	lb.	.15
Potassium Sulphuret, see Potassium Sulphide.		
Potassium Sulphocyanate	lb.	.70
Pumice, Ground	lb.	.05
Quartz, Powdered	lb.	.01
Rosin, Yellow	lb.	.04
Sal-Ammoniac, see Ammonium Chloride.		
Sal-Soda, see Sodium Carbonate.		
Silver Chloride, dry	oz.	.75
Silver Cyanide	oz.	1.00
Silver, Fine	oz.	.53⅜
Silver Nitrate, crystals	oz.	.50
Soda-Ash	lb.	.05
Sodium Biborate, see Borax.		
Sodium Bisulphite	lb.	.15
Sodium Carbonate (Sal-Soda), crystals	lb.	.02
Sodium Hydrate (Caustic Soda)	lb.	.05
Sodium Hydrate (Caustic Soda) by Alcohol (in sticks)	lb.	.45
Sodium Hyposulphite ("Hypo")	lb.	.04
Sodium Metallic	lb.	.90
Sodium Nitrate	lb.	.05
Sodium Phosphate	lb.	.09
Sodium Silicate (Water-Glass)	lb.	.04
Soot, Calcined	lb.	.15
Spelter, see Zinc.		
Sugar of Lead, see Lead Acetate.		
Sulphur (Brimstone) in lump	lb.	.05
Tin Chloride	lb.	.43
Tin, Metallic	lb.	.46⅝
Turpentine, Venice	lb.	.35
Verdigris, see Copper Acetate.		
Water, Distilled	gal.	.15
Water-Glass, see Sodium Silicate.		
Wax, Beeswax, yellow	lb.	.45
Wax, Carnauba	lb.	.70
Whiting (Ground Chalk)	lb.	.02
Zinc Carbonate, dry	lb.	.19
Zinc Chloride	lb.	,12
Zinc, Sulphate	lb.	.06
Zinc, (spelter)	lb.	.05½

THE BRASS WORLD AND PLATERS' GUIDE

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Screw Rod Chips and the Manufacture of Brass Ingot.

The extensive use of aluminum in making yellow brass sand castings, and the increase of such practice, have already brought about a singular condition in the manufacture of brass ingot, and will, in the future still continue to do so on even a greater scale. It has brought about a condition that to make good ingot brass, the raw material shall be free from aluminum.

This condition would appear almost a paradox, when it is taken into consideration that so many makers of yellow brass castings are now using a small quantity of aluminum in their metal, but the fact is that, while such brass founders may use aluminum in their yellow brass, they always prefer to add it themselves and this, perhaps, is the far better practice. By doing so they are able to introduce the amount required for their own particular work, and to ascertain from the appearance of the ingot which they purchase its quality. Were aluminum in the ingot metal, it might be excessive and in addition, the appearance of the surface would be no indication of its quality as it is when no aluminum is present.

The whole situation seems to be narrowed down at the present time to use of screw rod chips for making yellow brass ingot as it is practically the only class of material on the market at the present time which is free from aluminum. Casting chips, for yellow brass castings, are usually contaminated with it. While there occasionally can be obtained small lots of excellent material in the form of

sheet brass clippings, sheet skeleton brass, old cartridges, punchings and other forms of sheet brass scrap, the brass rolling mills usually pay more for them than the maker of brass ingot can afford to do and he has difficulty in purchasing them at a satisfactory figure.

Screw rod chips are now made in large quantities and can be obtained in large lots, absolutely free from aluminum and of very uniform quality. They are a very satisfactory material and are the principal source of raw material used for making yellow brass ingot metal.

Muriatic Acid the Best for Pickling Iron or Steel.

To remove iron rust or scale from iron or steel, one of three methods must be used:

1. By polishing the surface or similar grinding operation.
2. By the use of the sand blast.
3. By pickling in acid.

In many instances pickling only can be used. It is easily done and can be applied to all classes of work. In addition it requires no attention.

For the removal of rust or scale on iron or steel there is nothing equal to muriatic acid. It is much superior to sulphuric acid. Iron rust and scale are simply oxide of iron and muriatic acid (hydrochloric acid) is the natural solvent for it, while sulphuric acid (oil of vitriol) is not. This fact is exemplified by the fact that an ignited oxide of iron is scarcely soluble in sulphuric acid, while it may readily be dissolved by muriatic acid. Iron scale is really ignited oxide of iron.

If, therefore, a rapid and efficacious removal of iron rust or scale is desired, muriatic acid should be used. In using it for pickling, it should be diluted with water. The following proportions have been found excellent and give good results:—

Water	1 gallon
22° Muriatic Acid	1 gallon

In pickling, the object is to remove the rust or scale and not attack the iron or steel any more than is possible. Strong acid will attack the metal more rapidly than a diluted one, and this is the reason for the use of a diluted pickle.

In pickling, it is well to let the acid take its time. If slightly warmed it works more rapidly than when cold. The pickling may take 10 minutes, if there is but little rust on the metal, or it may take 10 hours when there is a thick scale to be dissolved. The best way is to let the operation take its time. Moving the articles in the pickle will greatly hasten the process.

Whenever possible, therefore, use muriatic acid for pickling iron or steel as it is, as previously mentioned, the natural solvent for oxide of iron.

Osmium as a Hardener for Platinum.

Pure platinum is quite soft, practically that of soft iron, and for many commercial purposes it cannot be used in this condition. In fact, nearly all commercial platinum is hardened. The usual hardening ingredient is iridium.

W. C. Heraeus, the well known platinum manufacturer of Hanau, Germany, has found that osmium is superior to iridium as a hardening metal for platinum. It is stated that 2% of osmium will harden platinum as much as 5% of iridium. The elasticity, however, is considerably greater. When iron or copper is present, the hardening effect of the osmium is considerably neutralized.

When the platinum contains more than 20% of osmium it becomes brittle. The alloying of the platinum and osmium must be carried out away from the oxidizing effects of the atmosphere as osmium itself is highly oxidizable and gives off poisonous fumes.

Cause of Disintegration of Aluminum.

H. Chatelier in *Compt. Rendus* gives the results of his experiments on the cause of the disintegration of aluminum. He found that in all cases of spontaneous disintegration of aluminum a cellular structure had developed and that the disintegration was apparently caused by the opening of the joints between the cells. Laboratory experiments pointed to the presence of small quantities of calcium as likely to bring on the formation of this cellular structure.

Silver Sweeps and Their Method of Treatment; With Notes on the Different Grades Found in the Trade.

The value of silver requires that all operations in which it is used in the arts shall be conducted with great care as regards the wastes resulting in its manufacture. Much greater care is now exercised than ever before and in former times, while it was considered that extreme care was displayed, there were many leaks for the silver. The majority of these leaks have now been stopped but there are some which still exist and are quite difficult to cope with. Among such leaks, so to speak, may be mentioned the loss occurring in the melting of silver through volatilization. This loss, though inconsiderable, when a small quantity of silver is concerned, nevertheless, some silver does volatilize and escapes and means quite a loss in the course of a year to those who melt much metal. Attempts have been made to recover such a loss (it is impossible to prevent it entirely) but the operation has not been attended with complete success.

In the manufacture of silver wares, both in making sterling silver wares and in plating, the wastes in which silver is present are more or less varied. The principal ones are as follows:

A Pile of Silver Sweeps, in Process of Being Mixed by "Turning Over" by Shoveling.

1. Floor Sweeps.
2. Polishings.
3. Buffings.
4. Filings, Sawings and Chips.
5. Dips and Pickling Solutions.
6. Old Cyanide Solutions.
7. Strips.
8. Racks.
9. Stringing Wires.

The treatment of these different classes of materials is not the same and some are pro-

duced only in small quantities and are readily treated.

As iron is usually employed for silver plating racks, there is little need for comment. The plater simply strips off the silver in a cyanide solution by using the rack as an anode, and deposits it upon a sheet of iron from which it drops off as soon as it becomes of any thickness. The silver thus obtained can be used for making chloride, or, as commonly done, melted and poured into a mold and rolled into an anode to be used again.

Stringing wires used in holding work to be plated, finally become coated with considerable silver and cannot be used. These are best stripped in a regular silver strip (sulphuric and nitric acid) and the silver recovered from this in the usual manner by dilution of the acid and precipitation as chloride with common salt. Instead, however, the wires may be dissolved completely in nitric acid and the silver thrown down in the metallic state by metallic copper.

Stripping solutions in which sulphuric and nitric acids have been used should be diluted with water and the silver precipitated with common salt in the form of chloride. This method also applies to firing dips and pickling solutions. The chloride of silver is recovered and either sold or used. It can be reduced to silver, however, by the use of metallic zinc and hydrochloric acid as described in THE BRASS WORLD, March 1911, page 98.

Old cyanide solutions may be sold to silver smelters direct but the difficulty of shipping and handling is great in such a case. The best method is to treat the cyanide solution with liver of sulphur solution as described in THE BRASS WORLD, January, 1911, page 13, when the silver will be precipitated as sulphide and may be filtered out. This sulphide may be sold or it can be dissolved in nitric acid and converted from this into chloride or metallic silver as explained in the aforesaid article.

Rich silver material and that which is lean should be kept separate and much more care is necessary with one than with the other. Polishings are usually fairly rich, while floor sweeps and buffings are lean. Filings, sawings and chips are very rich and should be kept separate and treated by themselves.

If the filings, sawings and chips have been kept free from brass, lead or other foreign metals, they can be melted to bullion of a high grade, but if contaminated with other metals, the metal obtained will be lower grade. Iron is almost invariably present in the form of tools, etc., and should always be removed after the material has been collected by means of a strong magnet. The material is then placed in a tub of water and the dirt and other light foreign matter washed away, using care not to wash out any of the silver itself. The washed material is then dried and melted down in a graphite crucible with a little borax as a flux. The bar obtained will usually have to be sold to silver refiners as it cannot be used. If pure, however, and facilities are had for rolling, it can be rolled into sheet again. The sources of contamination are so great, though, that it will usually be found expedient to sell the bullion thus obtained unless one is certain about its purity and means are had for rolling it.

The treatment of floor sweeps is one of the largest problems of the silver manufacturer, as they constitute one of the largest sources of loss and much care is required to prevent silver from completely disappearing. The best practice demands that *everything* shall be burned. When this is done there is no danger that something which was considered to be free from silver will be found to contain it after it has been thrown away and is beyond recovery. Buffings may be burned with the floor sweeps, but the polishings need only be dried as they do not contain matter which is combustible. If oily, however, as they often are when sand buffing has been done, they should be burned to remove it.

The burned sweeps, buffings and other material that has been put through the sweeps furnace (a sweeps furnace is simply a stove for burning them, and with as light a draft as possible to prevent the pass of fine particles) are then subjected to riddling. This operation is imperative in order to remove the iron, pieces of silver of considerable size and foreign matter that contains no silver. The material riddled out is then subjected to hand picking. Iron wire, pieces of cast iron, broken tools, etc., are all picked out and thrown away as they contain no silver. The remainder will be found to contain considerable silver in the form of small pieces and it is customary to melt this down under a flux of equal parts of borax and soda-ash. The bar of silver thus obtained is impure and should be sold to refiners.

The fine material that is left after riddling through a fairly coarse riddle (one-quarter

mesh riddle will answer for this operation) or in other words which passes through the riddle, is the real sweeps and contains some silver and a large amount of foreign matter in the form of dirt. As no silver manufacturer can smelt his own sweeps, it is necessary to prepare this material so that it can be sold. The smelting of sweeps requires a special plant which but few concerns can afford to have. The sweeps are smelted with oxide of lead in a blast furnace, after having been briquetted with lime, and a lead bullion obtained. This lead bullion is then cupelled and the lead oxidized again to lead oxide which is used over again. The silver obtained is slightly impure and is nitred to remove the last traces of lead and impurities present. The smelting of the sweeps by such a process, will, it can readily be understood, require a plant too expensive for any but those which accumulate large quantities of material.

While the sweeps may be sold after burning, the most satisfactory method is to grind them to a fine powder so that a fair sample can be obtained for assay. One assay of the material may then be made by the purchaser and another by the seller so that if an agreement is found, there is no chance for a controversy. Unless the sweeps are ground very fine, however, there is little chance for an agreement and a very wide difference in assays may be expected. This disagreement of assays is caused by both the imperfect mixing of the sweeps and the fact that the coarse material is filled with fine shot silver which, when samples are obtained, is not evenly distributed. The only safe way, therefore, is to grind as fine as possible and then mix thoroughly.

The burned sweeps (and nothing can be done with them unless they are burned) are put in a suitable apparatus in which fine pulverizing can be rapidly and safely carried out. For this purpose the so-called "Hill Barrel" has been found the best for the purpose. It is a heavy cast-iron tumbling barrel in which a heavy, hard-iron ball is placed. The sweeps are placed in the barral while dry and the hand-hole closed. The barrel is then revolved by power and the heavy ball pulverizes the sweeps to an impalpable powder.

The finely ground sweeps are now sifted through a 60 or 80 mesh riddle and the fine material left in the riddle will be found mainly fine silver shot. Any foreign matter such as iron may be removed and the remainder melted down in a crucible under borax. The bullion thus obtained is sold.

The fine material which has been riddled through the 60 or 80 mesh riddle is now thoroughly mixed by shoveling in the manner indicated in the illustration. This represents a large quantity of sweeps that has been ground, riddled and is in process of mixing.

When the finely ground sweeps have been completely mixed, samples can be taken from the pile, assays made, and if a fairly good agreement has been obtained in the results, the sale is concluded.

The sampling may be done at the works of the parties selling the sweeps or those who purchase them, but the method followed is the same. The whole operation depends upon the fine grinding and thorough mixing, otherwise there will always be a very wide difference in the assays made on the material and with the accompanying dissatisfaction of both the seller and buyer.

Composition of "Magnolia Antifriction Metal."

As frequent information is desired about the composition of "Magnolia Anti-Friction Metal," the following analysis and mixture formula may be of interest:

Analysis.

Lead	78.27%
Antimony	17.81%
Tin	3.88%
Copper	.04%

To make the mixture, it is customary to take the following as the amount of tin in the analysis is slightly lower than is generally introduced:

Lead	80 lbs.
Antimony	15 lbs.
Tin	5 lbs.

Or, if antimonial-lead is to be used (which will reduce the cost of the mixture considerably), the following should be taken:

20% Antimonial-Lead	100 lbs.
Pure Lead	26½ lbs.
Tin	6½ lbs.

Many babbitt-metal manufacturers now use this mixture for a lead-base anti-friction metal of medium grade.

The Advantage of a Large Amount of Boracic Acid in a Nickel Plating Solution.

In The Brass World, June, 1911, page 212, the results of some experiments on the amount of boracic acid a nickel plating solution will dissolve were published. The results showed that a far greater amount of boracic acid than usually supposed can be dissolved in the solution. It was found that it is possible to use at least 6 oz. of boracic acid to 1 gallon of nickel plating solution without having it separate out on cooling.

The usual or old formula for nickel plating solutions in which boracic acid is used, do not give very much of this substance. The amount of boracic acid usually recommended is from 1/8 to ¼ oz. This, however, has been found too small and a much larger quantity will give far better results.

Some nickel platers have been accustomed to use large quantities of boracic acid. While the average plater would purchase a few pounds of it, these individuals would buy it by the barrel. They were objects of criticism on this account as it naturally seemed that the boracic acid was wasted. This, however, has been found to be wrong and instead of criticising them. they should be praised. It may be of interest to state that the quality of the work turned out by the platers who used large quantities of boracic acid was very superior, and while the quality was supposed to have been caused by other things than this substance, in reality, it was the boracic acid which was responsible for the character of it.

The fact that boracic acid is advantageous in a nickel plating solution was first discovered by Edward Weston, the well known manufacturer of electrical measuring instruments, (Weston Electrical Instrument Co., Newark, N. J.) He discovered that this acid is advantageous and patented the use of it in nickel plating solutions in 1878. The patent of course, has long since expired. Mr. Weston was one of the pioneer electroplaters and had made a study of the subject. It was not until the past five years, however, that the real value of boracic acid has been fully appreciated. Now it is extensively used and should always be used in all nickel plating solutions. There has been the difficulty, however, that too little boracic acid has been employed and it should be borne in mind that as much as the solution will dissolve is the right proportion.

Since publishing the article previously mentioned upon the amount of boracic acid that a nickel plating solution will take up, experiments* were made to find the effect of this large amount on the deposit. The results obtained were so gratifying that there is no hesitancy in recommending the use of all the boracic acid the solution will dissolve. Coupled with this is the fact that several platers, who have used large amounts of boracic acid, have been noted for the fine quality of their work.

The advantage of boracic acid in a nickel plating solution is that the deposit is whiter, softer and freer from pits than when it is not used. These facts were discovered by Weston and mentioned in his patent specifications. When used by those who have not been in the habit of introducing boracic acid in a nickel plating solution, its advantage will at once be apparent.

There is also an additional advantage of boracic acid and that is its influence on pitting. Pits on nickel plated work are caused by bubbles of hydrogen gas adhering to the surface and preventing the nickel from depositing on it. When a large amount of boracic acid is used in a nickel solution, the evolution of hydrogen gas from the work is perceptibly less and unless an excessive amount of current is used, there will be little danger of pits forming.

To sum up, therefore, the advantages of boracic acid in a nickel plating solution are as follows:—

1. Increased whiteness of the deposit.
2. Production of a soft nickel.
3. Decreased tendency to pit.

Taking into consideration that all the boracic acid the nickel solution will stand can be used in it, the following standard nickel plating solution can be advantageously employed:

Water	1 gallon
Double Nickel Salts	8 oz.
Single Nickel Salts	1 oz.
Sal-Ammoniac	1 oz.
Boracic Acid	6 oz.

It is believed that this solution will give as good a nickel deposit, when used with a weak current, as it is possible to obtain from any known.

*Made in the Experimental Laboratory of The Brass World.

A New Method of Producing Ornamental Designs on Sterling Silverware.

By Charles E. Swett.*

In the early days of the Cobalt mining district, while handling a characteristic piece of ore, which was pure argentite on one end and graduated to pure silver on the other, it occurred to me that we might be able to do what nature had done: i. e. form a design in a plastic compound of silver, and after so forming reduce it to metal.

Fig. 1. Sterling-Silver Pitcher Before Treatment.

My first experiment was to make a plastic mixture of powdered silver, powdered silver chloride and oil of lavender. This mixture was applied with a brush in an ornamental design on a piece of spun silverware. After the oil of lavender had evaporated, the heat was increased until the chloride had agglutinated, thereby binding the particles of silver to each other and to the base on which it was applied.

The next step was to reduce the chloride of silver to metal. This being accomplished, the design remained as applied except that it was pure silver. It was, however, too porous to be of any use. I next found that by heating the article and touching the design with a thin pencil of silver chloride, enough of the latter would melt and be absorbed into the pores so that, when the reduction was repeated, the density was greatly increased, and also the adhesion to the base.

Fig. 2. Pitcher After Ornamenting.

Fig. 3. Fused Chloride of Silver.

This illustrates the principle, though I have greatly improved the technique, I have applied the principle† to building up other metals and alloys from both discrete particles and from compounds. The principle of the process, therefore, lies in fusing silver chloride on the surface of an article in any desired design, and then reducing it to metallic silver. The reduction may be carried out by heating in hydrogen gas, by means of py-

*Providence, R. I.

†The process has been patented by Mr. Swett (U. S. Patent 986,519)—*Editor.*

rogallic acid, or any other means known to chemistry.

Silver chloride fuses to a wax-like substance. It can be cut or whittled like celluloid. In Fig. 3 is shown such a piece of fused chloride. In Fig. 4 is shown a design that was made by fusing chloride of silver on to a surface of sterling silver, cutting or carving out the design, and then reducing the chloride to silver.

Fig. 4. Chloride of Silver Applied, Fused, Carved Out and Reduced.

The application of the process may be seen by reference to Figs. 1 and 2. In Fig. 2 is shown a sterling silver article with a plain surface. In Fig. 2 the same article is illustrated, but with the design produced by means of the chloride of silver as previously described.

The Occlusion of Gases by Brass and Phosphor-Bronze.

Guillemin and Delachanal contribute to the *Revue de Métallurgie* the result of the researches indicating that malleable brasses occlude from one to thirty volumes of gases, chiefly consisting of hydrogen, carbon dioxide, and carbon monoxide, the two last-named appearing especially in unsound pieces. The presence of hydrogen does not appear to have any unfavorable influence on the mechanical properties of the metal in sound malleable brass. On the other hand, phosphor bronzes contain only a small quantity of hydrogen and carbon dioxide, the presence of phosphorus seeming to reduce the capacity of the metal for occluding hydrogen. Finally, commercial tin in ingots or bars contains a small quantity of all three gases named.

Specifications for Copper Wire Bars, Cakes, Slabs, Billets, Ingots and Ingot Bars.

At the Meeting of the Sub-Committee on Pure Metals of the American Society for Testing Materials, the following specifications for copper were adopted. The meeting was on June 19th and the following are ones approved:

1. Marks:

All wire bars, cakes, slabs and billets shall be stamped with the maker's brand and furnace charge mark.

Ingots and ingot bars shall have a brand stamped or cast in, but need have no furnace charge mark.

2. Lots:

The refiner shall arrange carloads or lots so that each shall contain pieces from but one furnace charge so far as possible in order to facilitate testing by user.

3. Quality:

a. *Metal Contents:*

The copper in all shapes shall have a purity of at least 99.880% as determined by electrolytic assay, silver being counted as copper.

b. *Conductivity:*

All wire bars shall have a conductivity of at least 98.5% (annealed) and all ingots and ingot bars shall have conductivity of at least 97.5% annealed excepting only arsenical copper shall have a conductivity not less than 90% (annealed).

Cakes, slabs and billets shall come under the ingot classification, except when specified for electrical use at time of purchase, in which case wire bar classification shall apply.

The Annealed Copper Standard or resistance of a metergram or standard annealed copper at 20° C. shall be considered as 0.15302 international ohms. Per cent conductivity for the purposes of this specification shall be calculated by dividing the resistivity of the annealed copper by the resistivity of the sample at 20° C.

4. Physical Standard:

Wire bars, cakes, slabs and billets shall be substantially free from shrink holes, cold sets, pits, sloppy edges, concave tops and similar defects in set or casting. This clause shall not apply to ingots or ingot bars, in which case physical defects are of no consequence.

5. Weights of Individual Pieces:

Five per cent variation in weight or one quarter inch variation in any dimension from the refiners published list or purchaser's specified size shall be considered good delivery, provided however, that wire bars may vary in length one per cent from the listed or specified size; and cakes three per cent from the listed or specified size in any dimension greater than eight inches. The weight of ingot and ingot bar copper shall not exceed that specified by more than ten per cent, but otherwise its variation is not important.

6. Claims:

Claims must be made in writing within thirty days of receipt of copper at the customer's mill, and the results of customer's tests shall accompany such claims. The refiner shall be given one week from date of receipt of complaint to investigate his records, and shall then either agree to replace the defective copper or send a repsesentative to the mill. No claims will be considered unless made as above stated, and if the copper in question, unused, cannot be shown to the refiner's representative.

Claims against quality will be considered as follows:—

a. Conductivity by furnace charges, ingot lots or ingot bar lots.

b. Metal Contents by furnace charges, ingot lots or ingot bar lots.

c. Physical defects by individual pieces.

d. Variation in weights or dimensions by individual pieces.

7. Investigation of Claims:

The refiner's representative shall inspect all pieces where physical defects or weight or dimension variation is claimed. If agreement is not reached the question of fact shall be submitted to a mutually agreeable umpire, whose decision shall be final.

In a question of metal contents each party shall select a sample of two pieces. These shall be drilled in the presence of both parties, several holes approximately ½" in diameter being drilled completely through each piece, scale from set to be rejected. No lubricant shall be used and drilling shall not be forced sufficiently to cause oxidation of chips. The resulting samples shall be cut up, mixed and separated into three parts each of which shall be placed in a sealed package, one for each party and one for umpire if necessary. Each party shall make an analysis, and if the results do not establish or dismiss the claim to the satisfaction of both parties the third sample shall be submitted to a mutually agreeable umpire, who shall determine the question of facts, and whose determination shall be final.

In a question of conductivity each party shall select two samples and in the presence of both parties these shall be rolled hot and drawn cold into wire of 0.080" diameter, which shall be annealed at approximately 500° C. Three samples shall be cut from each coil and the same procedure followed as described in the previous paragraph.

8. Settlement of Claims:

The expenses of shipper's representative and of umpire shall be paid by the loser, or divided in proportion to the concession made in case of compromise.

In case of rejection being established the damage shall be limited to payment of freight both ways by the refiner for substitution of an equivalent weight of copper meeting these specifications.

Explanatory Note:

These specifications are intended to allow for the fact that the refiner produces copper and gauges its quality in furnace charge lots, while the user purchases copper in carload lots, necessarily obtaining a different basis for sampling.

It is intended to cover in these specifications an average grade of copper suitable for all mechanical uses and for making alloys to be used in various wrought forms.

It also recognizes the fact that certain shapes are largely put to electrical uses where high electrical conductivity is important.

It does not take into consideration the so-called casting copper used for the purpose of alloying with other metals to produce cast shapes.

Aluminum is an exceptionally difficult metal to electroplate. Even under the most careful conditions, the deposit will blister and peel.

Soot is extensively used in the acid dips employed in the large brass manufacturing centers. It renders the dips smooth working. It is not ordinary soot, but results from the burning of hard wood and is collected from chimneys in which this fuel is burned.

An Investigation of the Aluminum-Magnesium Alloys (Duralumin).

In *Metallurgie*, 1911, 8, 225-227, A. Wilm describes his experiments on the aluminum and magnesium alloys and which he calls "Duralumin". He had already shown that the addition of a small amount of magnesium to aluminum confers on it the property of being hardened by a heating process. Micrographic investigation has yet given no clue to the mechanism of this hardening, but certain of its peculiarities and their practical bearings have been investigated. Such an alloy heated to the requisite temperature (usually about 400° C.) and quenched, does not at once harden like steel, but shows practically no alteration; its hardness now gradually increases, however, and after 24 hours reaches its limit. Aluminum with 0.5% of magnesium is still a soft metal after this treatment, but the addition of copper greatly increases its hardness. These alloys can be cold worked after hardening, with the effect of still further increasing their hardness. Moreover, an alloy which has been cold rolled, with the effect of increasing its hardness and lowering its ductility, if it now be hardened by heating and quenching, not only gains further in hardness, but has ductility greatly raised.

The gain in hardness due to heating and quenching, increases as the temperature of the heating rises from 400° to 450° C., but further rise up to 540° C. causes no further increase in hardness. If the alloys, after heating to the desired temperature, be allowed to cool slowly, they will be much harder than the quenched alloys; but the slowly cooled alloys gain very little in hardness after cooling, and the ultimate hardness of the quenched alloy is always greater than that of the same alloy slowly cooled. If the quenched alloy be immersed in boiling water immediately after quenching, the rate of increase in hardness is enormously increased, but the ultimate hardness is not so great as that reached slowly in the cold. If, however, an alloy that has been hardened by quenching and standing, and has afterwards been cold-worked, be immersed in boiling water, the reduction in hardness is small, but the increase in ductility is very marked.

All of these aluminum and magnesium alloys may be kept or used at temperatures up to 150° C, without any deterioration; but at 200° C. and upwards, they lose hardness very considerably. Other metals introduced into these alloys affect their properties in various ways: Nickel gives toughness, manganese increases the hardness, and also has a curious effect of preventing the wetting of the alloy by mercury, and of course, the resulting atmospheric oxidation of the aluminum. But great caution is needed in alloying aluminum with these other metals, on account of the great tendency to segregation which they cause.

Improved Touchstone Test for Silver.

The use of the touchstone for testing gold, has been of long duration and is really the oldest method of testing known. In a German periodical A. Steinmann describes a method for testing silver by means of the touchstone.

The touchstone is, in reality, a basanite or Lydian stone and is used on account of its close-grained nature and, at the same time, slightly rough surface so that the metal is removed by rubbing.

As described by the aforesaid author, the silver is rubbed across the surface so that a streak is formed, and it may be said that either fine silver or the various alloys, such as sterling-silver, may also be tested. The streak is then touched with the following solution:

Nitric Acid, sp. gr. 1.27	40 parts
Glacial Acetic Acid	50 parts
Water	50 parts

By the use of this solution the difference between pure silver and that containing a small amount of copper may be distinguished. The amount of silver in an alloy may be determined approximately by comparing the behaviour of the alloy towards the reagent with that of alloys of known composition.

The cracking of pure gold during rolling is usually caused by the presence of impurities. Extremely minute quantities of antimony, arsenic or tellurium, as well as selenium and bismuth cause cracking. These impurities can only be removed by repeated additions of nitre while the gold is melted in a clay crucible.

Patchy Silver Deposits Produced by Sulphur in Potassium Cyanide.*

Platers are frequently bothered by the formation of bright patches on their silver plated work. The silver seems to cover the surface well, but in places the deposit, instead of having the customary dead appearance will have a bright look so that one might think that the silver had not covered it. This takes place too after the deposit has acquired some thickness so that it becomes evident that some abnormal condition has taken place.

The matter was recently brought to our attention by a plater in a large flat-ware manufacturing company who had been plating German silver flat-ware in the usual silver solution giving the regular dead silver deposit. This solution contained about 3 oz. of silver and 3 oz. of free cyanide per gallon. It was found upon testing that the solution needed more cyanide and some was added. Previous to this time the work had been coming quite satisfactory. The cyanide added was a new lot and had not been previously used. When added to the solution the flat-ware began to come out with a patchy appearance. One of the articles is herewith shown. The cause of the difficulty was not then apparent as all conditions were the same except the addition of the cyanide. Investigation showed that *sulphur* in the new sample of cyanide was the cause of the trouble.

The two kinds of cyanide used were then subjected to chemical analysis for sulphur and the following results were obtained:—

	Good Cyanide	Bad Cyanide
Sulphur	0.005%	.....0.07%

It will be noticed that the cyanide which caused the patchy silver deposit contained a considerable percentage of sulphur. It is customary in the silver plating trade to add a very small amount of bi-sulphide of carbon to a silver plating solution to produce a bright and smooth silver deposit. The introduction of this minute amount of sulphur causes the silver to deposit in a smooth condition. Why this takes place is not known, but the fact remains that sulphur is the cause, and it has been proved that compounds other than bi-sulphide of carbon and which contain sulphur will bring about the smooth deposit. The presence of sulphur in the cyanide, then, causes the silver to deposit in a partially smooth state. It should be understood that the reason that only a portion of the silver deposited in a smooth and bright condition on the article herewith illustrated, and which resulted from the use of the cyanide containing sulphur, was on account of the fact that a small amount of sulphur only was contained in it. Were a larger quantity present the whole deposit would have been smooth and bright.

*Results of some experiments carried out in the experimental laboratory of THE BRASS WORLD.

Silver Plated Article Showing "Patchy" Deposit on Account of Sulphur in Cyanide.

It may be of interest to cite an instance in which sulphur was introduced into a silver plating solution in another way, and which resulted in the formation of a patchy silver deposit. A concern manufacturing flat-ware adopted a new rack for holding the flat-ware. It contained parts made of hard rubber which, as well known, contains a large quantity of sulphur. After the racks had been in use for some time the silver began to deposit in

patches so that portions were bright and the remainder dead like that herewith illustrated. After considerable experimenting it was found that the hard rubber was the cause and that the sulphur was introduced from it.

As there seemed to be no way of removing the sulphur, it was decided that the better method would be to make all of the solutions over into "bright" ones and this, accordingly was done and the use of bright silver deposits carried on. Many flat-ware companies are now using bright silver deposits on the work as it has been found that a much greater quantity of silver can be put on in a given time.

It may be of interest to the reader to know of the method used for testing and estimating the sulphur in the cyanide. The best method was found to be that based upon the insolubility of mercuric sulphide in cyanide solutions.

A given amount of cyanide, say 100 grams, is dissolved in as small a quantity of water as possible (distilled water should be used). The solution is filtered to remove dirt and other foreign matter and a saturated solution of mercuric chloride (corrosive sublimate) is then added. About 50 c.c. of the mercuric chloride solution is used. The solution is then heated for some time in order to coagulate the black precipitate of mercuric sulphide that forms, when it is filtered through a weighed Gooch crucible. The crucible is then dried at 100° C. and weighed. The mercuric sulphide thus obtained contains 13.79% of sulphur.

To test a sample of cyanide for sulphur in a quantitative manner, all that is necessary to do is to add some mercuric chloride solution to it. If a black precipitate forms, it indicates that sulphur is present.

For reducing the acidity of a nickel solution, carbonate of nickel is the best material as it will neutralize the free sulphuric acid without disturbing the remainder of the solution, nor is any foreign material introduced. It is made by precipitating a hot solution of sulphate of nickel (single salts) by carbonate of soda, filtering and washing. It should *not* be allowed to dry, but is left and used in the plastic condition (moist state). If allowed to dry, it becomes hard and lumpy and will then neutralize the free sulphuric acid with difficulty.

Specifications for Spelter.

At the meeting of the Sub-Committee on Pure Metals of The American Society for Testing Materials, the following specifications for spelter were adopted on June 14th.

Under these specifications Virgin Spelter, that is, spelter made from ore or similar raw material by a process of reduction and distillation and not produced from reworked metal, is considered in four grades, as follows:

A High Grade
B Intermediate
C Brass Special
D Prime Western

Marks: A brand shall be cast in each slab by which the maker and grade can be identified.

Lots: The maker shall use care to have each carload of as uniform a quality as possible.

Composition:

A—High Grade: The spelter must not contain over

0.05% cadmium
0.03% iron
0.07% lead

It must be free from aluminum.

The sum of the lead, iron and cadmium must not exceed 0.10%.

B—Intermediate: The metal must not contain over

0.20% lead
0.03% iron
0.50% cadmium

It must be free from aluminum.

The sum of the lead, iron and cadmium must not exceed 0.50%.

C—Brass Special: The metal must not contain over

0.75% lead
0.04% iron
0.75% cadmium

It must be free from aluminum.

The sum of the lead, iron and cadmium must not exceed 1.20%.

D—Prime Western: Must not contain over

1.50% lead
0.08% iron

Physical: The slabs must be reasonably free from surface corrosion or adhering foreign matter.

Sampling: Not less than 10 slabs shall be taken as a sample from each car. For smaller lots in the same proportion to the total number, but in no case less than three slabs. In case of dispute half of the sample is to be taken by the maker and half by the purchaser; the whole to be mixed.

The slabs selected as samples are to be sawed completely across and the sawdust used as a sample. In case no saw is available for this purpose, the slabs should be drilled completely through and the drillings cut up into short lengths. The saw or drill used must be thoroughly cleaned. No lubricant shall be used in either sawing or drilling, and the sawdust or drilling must be carefully treated with a magnet to remove any particles of iron derived from the tools.

Analysis: Lead: For the determination of lead in High Grade not less than 25 grams; Intermediate not less than 15; Brass Special not less than 10; Common not less than 5 grams, must be taken, that is, the sample used for analysis should not contain less than 0.01 gram lead.

Iron: The sample for iron should contain not less than 25 grams for the three higher grades and not less than 10 grams for Common. The entire sample must be dissolved; the iron precipitated as ferric-hydroxide, then redissolved, reduced and the iron determined by titration.

Cadmium: Dissolve 25 grams in 330 c.c. of a solution of one part of hydrochloric acid (specific gravity 1.2) and five parts of water. Let it stand over night; filter and wash; reject filtrate and dissolve the residue, which should be about 5% of the zinc, in nitric acid. Add 10 c.c. of sulphuric acid; evaporate to fumes; dilute and filter out and wash the lead sulphate. Dilute the solution to 500 c.c.; add 5 grams of ammonium chloride; pass a slow stream of hydrogen sulphide for one hour and let stand for about five hours; filter, wash with hot water; dissolve in 10 c.c. of sulphuric acid and 50 of water; filter and wash. Dilute to 400 c.c.; precipitate with hydrogen sulphide as before. Weigh as cadmium sulphide or dissolve in hydrochloric acid and titrate with potassium ferrocyanide.

Claims: To be considered must be in writing within thirty days of receipt of material at customer's mill and the results of customer's test must be given. The shipper shall be given one week from date of receipt of such claim to investigate his records and then shall either agree to satisfy the claim or send a representative to the mill.

a. *Analysis by Car Lots:*

No claims shall be considered unless the minimum samples as specified for the grade in question can be shown such representative.

b. *Physical Defects of Individual Pieces:*

No claims shall be considered unless the spelter in question, and unused, can be shown such representative.

Mill Treatment: Where the spelter satisfies the chemical and physicial requirements of these specifications it shall not be condemned for defects of alloys in which it is used or for defects in the coating of galvanized products.

Investigation of Claims: The maker's representative shall inspect all pieces where physical defects are claimed. If agreement is not reached the question of fact shall be submitted to a mutually agreeable umpire, whose decision shall be final.

On a question of metal contents an adequate sample shall be drawn by the representatives of both parties; the sample shall be prepared from the slabs so selected as described under *Sampling.* The sample shall be mixed and separated into three parts, each of which shall be placed in a sealed package, one for each party and one for the umpire if necessary. Each party shall make an analysis and if the results do not establish or dismiss the claim to the satisfaction of both parties, the third sample shall be submitted to a mutually agreeable umpire, who shall determine the question of quality and whose determination shall be final.

Statement of Claims: The expenses of the maker's representative and of the umpire to be paid by the loser or divided in proportion to concession made in case of compromise.

In case of rejection being established, damages shall be limited to the payment of freight both ways by the maker or substitution of an equivalent weight of spelter meeting these specifications.

Copper may be welded by the use of a mixture of equal parts of boracic acid and phosphate of soda. The mixture is used in the same manner as in welding iron or steel, but should first be dried.

A New Test for Galvanized Iron to Replace the "Preece" Test.

The testing of galvanized iron is now carried out by all large consumers in order to determine whether the desired amount of zinc has been put on the iron. The usual method of testing it is by means of the "Preece" test. This consists in placing the piece of galvanized iron to be tested in a solution of copper sulphate, and noting the number of one minute immersions that can be carried out until bright iron shows. After each immersion the spongy copper precipitated on the surface is wiped off. This method, of course, is only relative and does not give any information about the actual amount of zinc on the surface. In ordinary practice, however, there is no need of such knowledge, and test is used to indicate whether a sample of the galvanized iron is up to standard.

In a paper in the *Journal of Industrial and Engineering Chemistry,* April, 1911, Walter A. Patrick and William H. Walker have investigated the testing of galvanized iron by means of the "Preece" test, and have found it unsatisfactory. As a result of their investigations, they have evolved another method which they believe to be far superior.

The use of a slightly basic solution of lead acetate (sugar of lead) is recommended as a solution to be used in place of sulphate of copper. It is prepared by dissolving 400 grams of crystallized lead acetate in 1 litre of water, and then agitating the solution with 4 grams of litharge. The litharge is used for neutralizing any free acid that may be present in the lead acetate. The solution is filtered and diluted to a specific gravity of 1,275. This gives a solution which dissolves zinc and a zinc iron alloy, but does not attack the iron base as sulphate of copper does.

To use this method, the piece of galvanized iron is completely covered with the solution. It should be placed in a glass vessel. The piece is allowed to remain in the solution for three minutes, when it is removed and wiped. If the zinc is not removed, the immersion is again carried out for three minutes, and if necessary repeated as many times as required. When a bright iron surface has been obtained, the end has been reached and the number of immersions required are noted.

This method also has the advantage that the actual amount of zinc on the galvanized iron may be found. The piece of galvanized iron is weighed before and after immersion, and as the lead acetate does not attack the iron, the difference will accurately give the amount of zinc on it. By taking a piece of the galvanized iron an inch or a foot square, it is easy to calculate the amount of zinc on such a surface. In the case of wire, the length, of course, is the quantity taken.

The advantage of this method lies in the fact that the iron is not attacked at all, while in the sulphate of copper or "Preece" test, it is for the reason that iron precipitates copper. The lead acetate method, therefore, is as accurate as one would desire, and while slower than the "Preece" method, the length of time is really an advantage as it renders the operation more certain and safe.

Advantage of a Weak Acid Dip on Nickel Plated Work.

As all nickel anodes contain iron, and a slight amount of this metal deposits with the metal, there is also a tendency for the nickel to tarnish to small degree. With nickel plated work which is buffed, this has no bearing, but goods which are left without buffing such as those done in a plating barrel, frequently have a slight stain on the surface when dried out.

This stain may be renewed by the use of a weak pickle. Muriatic acid is excellent for this purpose, but it should be rather dilute. Two parts of water to one part of muriatic acid will give good results. Run the work, after it has been well rinsed in water, through this pickle and then again carefully and thoroughly rinse. Without drying, run through a weak soap solution, such as whale-oil soap, and then rinse again. The greasy soap leaving a slight film of oil on the surface of the nickel, will allow the rinse water to break and, therefore dry more rapidly, and at the same time lessen the stain.

In making manganese-bronze with the intention of obtaining the highest possible strength, the best grade of spelter containing the minimum amount of lead should be used. There is so much lead in ordinary grades of spelter that the strength is affected.

Porcelain Casseroles vs. Evaporating Dishes for Electroplaters' Use.

Porcelain evaporating dishes are extensively used by electroplaters for making up silver and gold solutions and salts, and for other operations. The advantage of porcelain over glass is that it is not so readily broken by the heat. A good porcelain vessel will stand sudden changes of heat that would crack glass.

The only difference between an evaporating dish and a casserole is that the casserole has a handle. They are not made in sizes larger than about 2 quarts for the reason that the handle would not hold. They are also less flat in shape. The porcelain in them is the same.

Platers should always purchase the best porcelain ware as it is the cheapest in the end. Cheap ware is apt to crack and will not stand the changes in temperature that the best grade will. The finest quality is known as

Fig. 1. A "Royal Berlin" Porcelain Casserole, Showing Advantages Over Evaporating Dish.

For small dishes of 2 quarts or under, a casserole is much more convenient than an evaporating dish as it is more readily handled. "Royal Berlin Porcelain" and is made only in one factory in Berlin, Germany. It can be obtained through chemical dealers. The

Fig. 2. An Evaporating Dish. More Difficult to Handle Than the Casserole.

evaporating dish and casserole shown in Figs. 1 and 2 are of this grade. Beware of casseroles with wooden handles as they are of inferior grade and usually quite thick so that they will not stand the heat.

An Attempt to Use Monel-Metal in Making German-Silver Sand Castings.

The fact that "Monel-Metal", which contains approximately the following:—

Nickel	75.00%
Copper	23.00%
Iron	2.00%

can be obtained so cheaply, has rendered it attractive for the manufacture of German-silver castings. In other words, it supplies a very cheap source of nickel, so that one of our subscribers, who manufactures a considerable quantity of German-silver sand castings believed that "Monel-Metal" could be used for supplying the nickel so that a metal much cheaper than that ordinarily made from pure nickel would be obtained. The castings were made of the ordinary mixture of German-silver to which a small quantity of aluminum was added to render them sound when cast in sand.

The castings thus obtained when the nickel was introduced into the German-silver by means of "Monel-Metal" were quite inferior and could not be used. The color was dark and had a rusty appearance. The castings were not as clean as desired and they had the appearance of having considerable iron in them. The metal also formed considerable dross.

The difficulty in using "Monel-Metal" for this purpose is mainly on account of the iron in it. Although ordinarily from 1% to 2%, it frequently runs as high as 5% so that the German-silver produced contains enough iron to give unsatisfactory casting qualities to it. It also contains more or less carbon which, as well known, has a tendency, by separation from the parent metal when copper is added, to cause dirt or dross to form. It would seem, therefore, that "Monel-Metal" cannot be used for introducing nickel into copper alloys without imparting unsatisfactory properties to them.

The Properties of the Vanadium Bronzes.

In a paper by George L. Norris presented at the Meeting of the Mining and Metallurgical Section of the Franklin Institute of Philadelphia, Pa., and published in the June issue of the Journal of the Franklin Institute, an elaborate description of the properties of the vanadium alloys is given. The major portion of the paper is devoted to the vanadium steels, but some interesting data in regard to the non-ferrous alloys containing vanadium is also published. He says:

"Cupro-vanadium usually contains about 3% of vanadium. The eutectic contains about 7% of vanadium. Mixtures containing a high percentage are not desirable on account of the very high melting point and consequent difficulty in getting it into the alloys.

Vanadium has hardly entered the field of non-ferrous alloys, although I firmly believe that in the near future it will be found occupying almost as prominent a place in these alloys as it does at present in steel. The principal reason for this apparent lack of progress has been due largely to the difficulty of producing cupro-vanadium free from undesirable metals, notably iron and aluminum.

Vanadium has a very high electrical resistance, and the addition of only a few hundredths of a per cent reduces the conductivity of copper to a marked degree. A few hundredths of a per cent will increase the elastic limit, tensile strength and ductility of copper from 10 to 20 per cent.

About the first reference to the use of vanadium in non-ferrous alloys is contained in an article by Helouis. He produced some experimental bronzes, notably an aluminum bronze 94.5% copper, 5.5% aluminum with 0.5% vanadium, which gave a tensile strength of 97,336 as against 49,770 pounds per sq. inch for the same alloy without vanadium.

Vanadium has a very similar effect on the copper alloys that it has on steel. It increases both the elastic limit and tensile strength very materially and does not impair the ductility. Usually the ductility is increased. A recent test of vanadium in common brass or Muntz-metal, 60% copper and 40% zinc, gave the following results:—

	Without Vanadium	*With Vanadium (Trace Only)*
Ultimate Strength	38,000 lbs.	49,000 lbs.
Elongation in 2 inches	28%	45%
Reduction in Area	30%	42%

The increase in resiliency by tests on notched bars was a little over 80%.

Tests of vanadium in manganese-bronze gave the following results:—

	Manganese Bronze	*Manganese-Vanadium Bronze*
Ultimate Strength	54,160 lbs.	81,440 lbs.
Elastic Limit	30,560 lbs.	50,560 lbs.
Elongation in 2 in.	22%	12%
Reduction of Area	18%	14%

COMPOSITION

	Manganese Bronze	*Manganese-Vanadium Bronze*
Copper	58.81%	58.56%
Zinc	38.08%	38.54%
Aluminum	1.22%	1.48%
Manganese	0.69%	0.48%
Iron	0.84%	1.00%
Vanadium	.....	0.03%

The micro-structure of these bronzes also shows a very marked difference.

A very considerable amount of vanadium-bronze is being made of a composition similar to manganese-bronze, without manganese. This bronze is very strong, forges readily and resists corrosion to a high degree. It is being used extensively for marine work, especially in torpedo and submarine boats. A cylinder 3 in. in diameter, 15 inches long and 9/16 in. walls has stood up under 9,000 lbs. water pressure. Tests of this bronze, both cast and drawn into rods and wire are as follows:

	Cast
Elastic Limit	28,500 lbs.
Ultimate Strength	71,000 lbs.
Elongation in 2 in.	32.0%
Reduction of Area	27.8%

	Cold Drawn 5/8 in. Rod	3/8 in. Wire
Ultimate Strength	92,000 lbs.	100,700 lbs.
Elastic Limit	80,000 lbs.	81,500 lbs.
Elongation in 2 in.	11.5%	12.0%
Reduction in Area	29.3%	33.6%

The possibilities of vanadium in bearing metals, both bronze and babbitt I believe to be great. Work along this line has made little progress largely owing to the fact that the vanadium alloys at present available contain aluminum, and this element and lead are quite antagonistic towards each other. I have a report of a large circular step-bearing in a plate glass grinding machine that encourages me in my belief, that vanadium will improve the quality of the bearing alloys. These bearings are subject to a load of 900 to 1000 lbs. per square inch and make about 30 r. p. m. It has always been difficult to get a bearing metal hard enough to stand the pressure. This vanadium bearing metal was practically the standard American car journal bronze with approximately 0.05% of vanadium added, and the bearing stood up twelve months with no appreciable wear.

Aluminum and vanadium readily alloy as was discovered by Moissan in 1896. Moissan's alloy contained 2.5% of vanadium, was stronger and a little harder than pure aluminum. Helouis, in the article previously referred to, made mention of an alloy of aluminum and 1% of vanadium which had a tensile strength of 24,174 lbs. per sq. in. He also called attention to the remarkable sonority of these alloys.

Matignon and Mounet produced an alloy of definite atomic composition AV containing 32.81% of aluminum and 67.87% of vanadium. The principal application of alumino-vanadium will be as a means of introducing vanadium into aluminum and aluminum alloy castings, wire, sheets etc., and consequently a low melting alloy will be required. The melting point, of course, rises with the percentage of vanadium. Recent experiments indicate that an alloy of from 5% to 10% of vanadium will prove most satisfactory. There is every indication that the use of vanadium in aluminum alloy castings will very considerably increase the strength and ductility.

Steel containing over 20 per cent of manganese is non-magnetic. A non-magnetic steel is also produced by alloying 17 per cent of aluminum with iron.

Electrogalvanizing solutions will not "throw" their zinc deposits to a great depth in plating, and in this respect resemble acid copper solutions. It is impossible to deposit zinc in deep pockets. Cyanide solutions of metals always "throw" the deepest.

New Books.

ELECTROPLATING by Henry C. Reetz. Size, 5 x 7 inches. Bound in Cloth, 99 Pages, 62 Illustrations. Price 50 cents, Postage Paid. *Popular Mechanics Co.,* Chicago, Ill. This book is one of the series of treatises published by this company. The book is not intended for advanced platers, but only for beginners and contains elementary information that will prove of value to those who are beginning electroplating. It contains instruction on polishing and buffing and the finishing of metals. There is also a chapter on lacquering.

NITROCELLULOSE INDUSTRY by Edward Chauncey Worden, Ph. C. M. A., F. C. S. 2 Vols., 1239 Pages, 6 x 9, bound in Cloth. 324 Illustrations. To those who are interested in the manufacture or use of lacquers, this book will prove something that has long been sought. Heretofore there has been nothing published on the subject that has been modern. The nitrocellulose lacquers are now so extensively used, that an extensive treatise on .the subject must prove of great value The book treats on the entire nitrocellulose industry, from the nitrating of the cotton up to the manufacture of the finished product. Celluloid, lacquers, amyl-acetate and other solvents, smokeless powders, imitation leathers, and other materials allied to the industry are all treated in a very exhaustive manner. As far as the lacquer end is concerned, it may be said that the book leaves little to be desired, and the entire subject has been taken up, giving formulas, method of making etc., etc. Although a very extensive treatise and written from a scientific standpoint, it is readily understood by those who are not versed in chemical science. The author is to be congratulated in having written a book which, although a strictly scientific treatise, is readily understood by the layman.

The book should be in the hands of all lacquer manufacturers and users. We feel sure that it will prove a valuable work of reference and an instructive text book. As the first treatise on the subject published in the English language, it is a worthy contribution to science. Published by The D. Van Nostrand Co., New York City. Price. 2 vols, $10.00.

THE PRINCIPLES OF SCIENTIFIC MANAGEMENT. By Frederick Winslow Taylor, M. E., Sc. D. Past President of the American Society of Mechanical Engineers. 144 Pages, 6 x 9, Bound in Cloth. *Harper & Brothers, New York City. Price, $1.50, Postage, 11 cents.*

This is the system which was regarded as a discovery when Louis D. Brandeis declared that, by adopting it, the railroads of the country could save a million dollars a day. Scientific managemeut has now been introduced into many of the great factories and plants of the country—like the Link Belt Manufacturing Company, the Yale & Towne Company, the repair shops of several railroads, and it is now spreading to printing establishments, bleacheries, cotton-mills, optical works, and many other manufacturing plants. Applied to brick-laying, it has shown the possibility of revolutionizing the art, making it easy for a man to lay from two to three times as many bricks as before. Applied even to unskilled operations, like shoveling and carrying pig-iron, its favorable results have been amazing. In all these occupations it is producing a wholly new spirit of co-operation between the employer and the employee; it is enabling the employee to earn more wages and to look upon his work not as a drudgery, but with the pride of the true worker; and at the same time it enables the manufacturer to make greater profits. It is beneficial alike to small concerns and to greater establishments.

A Method of Producing Thin Enameled Watch Dials.

The tendency towards the use of very thin watches, has brought about the need for a thin dial. The usual method of making watch dials is to enamel on one side, but it is difficult to prevent the enamel from flowing on the back. When used on the watch, therefore, it tends to thicken it.

Edgar L. Hull of the Waltham Watch Co. of Waltham, Mass., has recently invented a process for making a thin dial. He enamels the dial on one side (copper is used for the base) and then coats the face with a resisting wax. The dial is then treated with hydrofluoric acid which dissolves off the enamel from the back side and leaves the bare metal. The front, being protected by the wax, is not acted upon by the acid.

Cause of the Corroding of Magnesium.

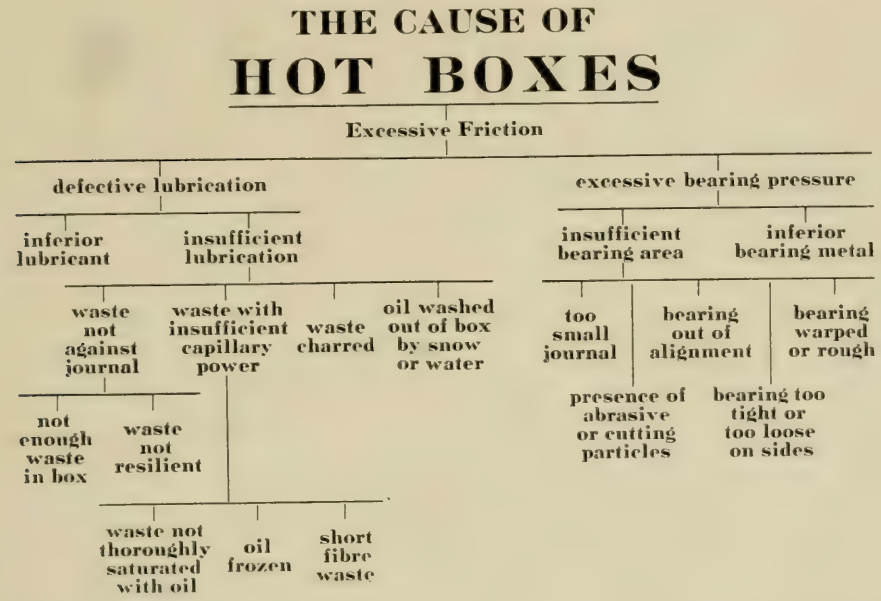
Magnesium is such a light metal and is so much superior to aluminum in this respect, that it is quite attractive as a constructing material where lightness is essential. One of the difficulties found in its use for such a purpose, was its tendency to corrode when exposed to the atmosphere. A white oxidation in the form of rust would soon appear.

The Chemische Fabrik Griesheim-Electron of Frankfort, Germany have found that the presence of chlorine in the metal is the cause of the oxidation. This is introduced in the process of manufacture. In order to eliminate it, they have found that moist hydrogen gas, passed through the molten metal will remove it in the form of magnesium oxychloride which floats to the surface and may be skimmed off. The magnesium thus purified resists corrosion far better than the untreated material.

The electric welding of copper trolley wire has been found unsatisfactory, on account of the oxidation of the copper when the welding takes place. The wire is now brazed together with silver solder and this method has been found satisfactory. It is almost universally used in the making of long lengths of wire.

Cause of Hot Journal-Boxes.

The accompanying diagram in regard to the cause of hot journal boxes or bearings has been compiled by McCord & Company, People's Gas Building, Chicago, Ill., as illustrating the various causes which enter into the problem. It will be noticed that there are numerous sources of the difficulty, and while the table was compiled more particularly for railroad use, it will be found of interest to those who come in contact with any class of bearings.



The continuous electrodeposition of two metals of the same color at the same time is a difficult matter on account of the impossibility of maintaining the necessary proportions of the two metals in the deposit. While silver and nickel may be deposited together from a cyanide solution, the proportions are continually changing and there is no method, except actual chemical analysis at very frequent intervals, of determining the proportions While the electrodeposition of the two metals is possible theoretically it is exceptionally difficult practically. In the case of two metals of different color, like copper and zinc, the deposit changes color when abnormal conditions take place.

Melting Scrap Nickel Anodes.

While it is usually considered that the re-casting of old nickel anodes by anyone except those who make a business of manufacturing them does not pay, there may be instances in which it is desired. It is considered costly for the reason that the melting and casting operation is a matter that requires equipment and the average brass foundry and brass melting equipment is not quite sufficient to cope with the situation. The heat required in melting the nickel is high, and the molding requires special knowledge. For this reason, it will usually be found that it is more economical to sell the old anodes to the makers of nickel anodes, who will always purchase them at a good price.

Those who desire to melt the old anodes, should proceed along the following lines: Carefully remove all hooks, or wires from them as these are always brass, copper or German-silver and will introduce copper in the nickel which is very deleterious as it darkens the nickel deposit. Place them in a graphite crucible after having been broken up into small pieces so that they will pack well. Do not fill the crucible full but only about two-thirds and the crucible itself should not be large. It has been found expedient to use a comparatively small crucible as the melting then proceeds more regularly and rapidly. A No. 40 is a size frequently used and a smaller crucible will give even more rapid results.

When the crucible has been charged with the old anodes, cover it to a depth of about 1 inch with a flux composed of 2 parts of lime and 1 part of fluor-spar. These should be well mixed before using.

Place a lid on the crucible and begin the melting. Coal, coke, oil or gas may be used for the fuel, but whatever is used, must be capable of giving a high heat. The use of coal or coke without a blast is usually attended with difficulties, unless a high stack is had. The nickel melts at about the temperature of steel.

When the whole is melted, the stirring may be done by means of a graphite stirrer, although really unnecessary because the metal mixes itself in the fire. It is usually desirable, however, to use the stirrer to ascertain whether all is melted.

Remove the crucible and skim off the slag on the surface. Then pour into the mold. The mold itself is made of sand in the same manner that a brass mold is constructed for making brass castings, but must always be dried. Green sand chills the nickel so that it will not run. The sand that has been found most satisfactory is the so-called "French-Sand" used in making bronze statues. It can be rammed hard and then dried clear through or skin-dried as may be desired and leaves a good surface on the mold. The face of the mold is coated with graphite of a suitable kind before casting in order to prevent the metal from burning into sand. After the anode has been cast it should be sand blasted, if possible, to clean it and give the ideal surface for use in the nickel plating solution.

French Method of Removing Grease Previous to Electro-galvanizing.

According to a recent French patent, grease may be removed from goods to be electroplated, particularly those to be electrogalvanized, by a modification of the ordinary method. The process customarily followed in removing grease and oil from such goods is to treat them with a solvent for these substances. It is open to the objection, however, that the solvent containing the grease remains in contact with the surface, and when it evaporates, a film of grease is again left on. A perfect cleaning is then never obtained.

The French process obviates this difficulty by the use of an apparatus in the form of a condenser and still. The solvent, such as benzine, is sprayed on to the goods to be cleaned and removes the grease and is so arranged that only the condensed material comes in contact with the surface of the articles being cleaned. The grease thus removed remains in the bottom of the still. Before opening the apparatus, an inert gas, such as carbonic acid gas, is forced through to displace all benzine vapors and thus avoid any danger. Other solvents of a volatile nature, such as carbon tetrachloride, acetone, or similar substances may be employed for the removal of the grease, but benzine is generally used on account of its cheapness.

An Improved English Method of Casting Copper or Brass for Rolling.

The ordinary method of casting brass for rolling is to pour the metal into an iron mold at its top. This practice, while open to many objections, has always been used for the reason that no other method was known. The disadvantage of pouring brass into the top of the mold is that it is exposed to the air while the pouring is taking place, dross and oxide may enter with the metal, air becomes entangled and the metal striking on the sides of the mold is frequently apt to produce an imperfect spot.

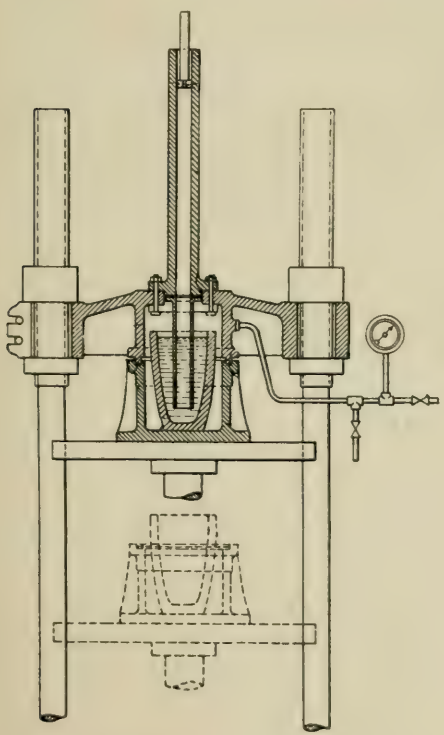


Fig. 1. Upright Cross-Section of Apparatus.

Frederick Tomlinson of the Broughton Copper Co. of Manchester, England, has recently devised a mold and appliance for casting rods and bars for rolling that seems to be along the right lines. The company has supplied us with sketches illustrating the process. The principle lies in casting the metal from the bottom of the mold, thus obtaining it free from foreign matter, and without exposure to the air. The company informs us that while the appliance has been patented in Great Britain, no patent has been taken out in the United States.

Fig. 1 will illustrate the method employed. The metal is melted in a crucible and then placed in a closed chamber. Over this chamber a cover is placed and this cover has the mold attached to it at its top. This cover is forced down over the chamber containing the crucible by means of a hydraulic ram or suitable device. The portion which projects into the molten metal in the crucible, is not a part of the mold, but serves simply as a conduit to guide the metal to the bottom of the mold.

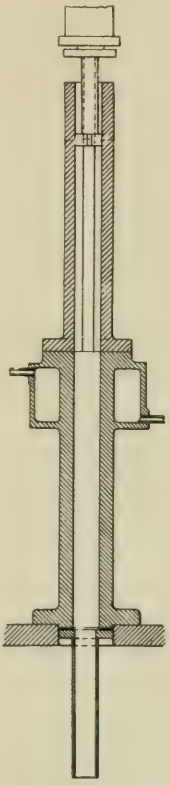


Fig. 2 The Mold.

In the bottom of the mold, is a sheet of asbestus which prevents access to the atmosphere. A pipe in the side of the chamber is used for putting a pressure on the metal and thus forcing it up into the mold. Carbonic acid gas or other inert gas which will not oxidize the metal is used as the pressure medium.

In Fig. 2 the mold is shown in detail and in this case a water jacket is shown which may be used to cool the top of the mold and thus solidify the top of the casting before the bottom begins to cool so that there will be no gate end. Fig. 3 is a plan of the cross head, and Fig. 4 is a plan of the guides.

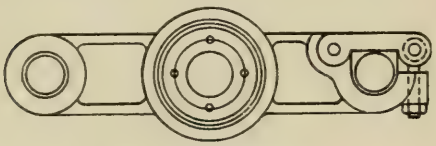


Fig. 3. The Cross-Head.

The method of using the apparatus is as follows: The metal is melted in the crucible and placed inside of the chamber. The cross-head carrying the mold is then let down upon the chamber and pressure applied. The pressure bursts the asbestus sheet in the bottom of the mold and the metal is then forced up into the mold. A ram in the top of the mold is then used (after releasing it from the chamber) to force the casting out of it.

Fig. 4. Cross-Section of Guide.

The Broughton Copper Co. advise us that some experimental work is still necessary on the apparatus to render it all that is desired, but that so far they believe it is along the right lines for casting metals for rolling.

An Improved Pyrophoric Alloy.

The use of pyrophoric alloys has now become quite common. They are used for producing a spark which, in turn, ignites gas or other inflammable substance as may be desired. The spark is emitted from the alloy by striking it or rubbing it against a hard steel surface that is slightly rough.

The base of these pyrophoric alloys is certain. The ordinary alloy consists of cerium and iron. According to a German patent recently issued to Adolf Huber of Kunheim & Co. of Berlin, Germany, aluminum imparts a property to the alloy which renders it still more pyrophoric so that the sparks are larger. The amount of aluminum used is about 12%, although it stated that less can be used with good results.

Spurious Old Sheffield Plate.

The following article from *The Ironmonger* of London, England will serve to illustrate the condition of the so-called "Sheffield Plate" industry, and also explain the meaning of the term as it is understood in England.

"There is reason to believe that the prosecution of a Belfast dealer in antique goods for selling spurious Old Sheffield Plate (reported in our issue of June 3, p. 63) marks the beginning of an active campaign for checking a trading practice which has made great headway in recent years. The case reported was the first of its kind in connection with the ware named which has been tried in the courts, and the fact that a conviction was obtained will probably lead to others. Although the complainant in the Belfast action was a private person, he acted with the support and co-operation of the Sheffield Cutlers' Company and the Sheffield Master Silversmiths' Association, both of which bodies feel that some responsibility rests upon them in protecting collectors of Old Sheffield Plate from wasting their money on worthless imitations turned out of present-day workshops in Germany or Birmingham. Few things which are "collected" lend themselves more readily to deception than Old Sheffield Plate, much experience and study being necessary to detect the counterfeit, while as an article worthy of collection it has become very prominent of late, and the rarer specimens now fetch extremely high prices. Taking advantage of these circumstances, and of the prevailing lack of knowledge of the subject, some manufacturers have been turning out imitation old plate in wholesale quantities. The United States has long been a happy hunting ground for the makers of these sham goods. Hundreds of well-to-do American citizens now display to their visitors, with pride and happiness, cabinets stocked with so-called "Old Sheffiield Plate," for which they have paid fancy prices, but most of which is not old and was never in Sheffield. In buying such ware in curio shops extreme caution is advisable, because much of it is not genuine and the dealers themselves are often deceived.

The term Old Sheffield Plate means table hollowware made of copper, coated with silver by fusion followed by rolling and hammering. The discovery of this method of producing an

article resembling silver plate, but much less expensive than it, played a highly important part in the commercial development of Sheffield from about the year 1740 until 1850, when it was entirely superseded by the cheaper process of electroplating, in which the copper is covered with a coating of silver by a chemical process. An appearance of age is often imparted to electroplated ware by artificial means, but such goods have no antiquarian value whatever. A buyer of Old Sheffield Plate is often satisfied of its genuineness on being shown a worn part which reveals the copper base, but without the assistance of an expert it is unsafe for an inexperienced person to buy such goods unless from a dealer in whom he has reason to feel confidence. In the Belfast case the defendant had ticketed the goods bought by the prosecutor at comparatively moderate prices for so-called "old" articles. It is true that they would have been dear as ordinary articles of domestic use, but really genuine goods of the kind which they professed to be would command much higher figures than those, at which the goods were sold in the defendant's shop."

A New Aluminum and Magnesium Alloy.

A new alloy of aluminum and magnesium has recently been patented by Conrad H. H. Claessen of Berlin, Germany. He says that while it has been proposed to increase the strength of aluminum by the use of magnesium, it has been found that over two per cent are required to obtain the necessary results. He has found it possible, by the use of a small amount of copper with the aluminum and magnesium, to obtain the desired results with a much less quantity of magnesium. The mixture employed is as follows:

Aluminum	95.5%
Copper	4.0%
Magnesium	0.5%

It is stated that the magnesium imparts hardness and strength to the alloy to such an extent that it becomes greatly improved.

The use of boracic acid in a nickel solution renders the deposit whiter and of an even color free from stain and discoloration.

Artistic Effects Produced by Colored Enamels and the Spray.

The use of the spray for the application of colored lacquers and enamels is rapidly extending and the future will unquestionably find it even more widely employed. Its advantage lies in the fact that as many coats of lacquer as desired may be applied. When lacquer is brushed on or applied by dipping this cannot be done for the reason that each succeeding coat removes the previous one by dissolving.

Spelter Statue Finished With Enamel Lacquer by Means of Spray.

We are indebted to the Celluloid Zapon Co. of New York City for the excellent example of enameled work herewith illustrated. In appearance this statue very closely resembles the most carefully applied corrosive and oxidized finish. The entire finish was applied with the lacquer spray and no plating of any

kind was used. The Celluloid Zapon Co. supply us with the following information in regard to the method used in finishing the statue:

"The statue is a spelter casting and the color of the metal has no influence on the finish as it is entirely covered with enamel. The statue was first given a coat of brown enamel and allowed to dry. A coating of verde enamel was then applied and in this operation the spray was held far enough away from the figure so that the green was partially dry when it struck. This still had enough solvent to make it hold to the brown enamel, but not enough to cause the two to unite.

About 5% of thinner was added to some turpentine and a piece of felt barely moistened with it. The high lights were rubbed over with this while the verde enamel was still fresh. The green is easily removed from the high lights, but the brown underneath is not removed. If the high lights have been well buffed, the brown enamel will throw off a very decided metallic lustre. If it is desired, this metallic lustre can be increased by taking some striping bronze and barely touching the fingers to it so as to pick up a very small amount. The figure is then rubbed over on the high lights. In this way an exceedingly small amount of the striping bronze adheres to the high lights and produces a decided metallic appearance. It is a matter of personal taste whether the brown is left as it is, or the lustre increased with the bronze. The entire figure is then given a protective coating of "Zapon K" lacquer, thinned out one-half. If a higher lustre is desired, the lacquer is applied without thinning.

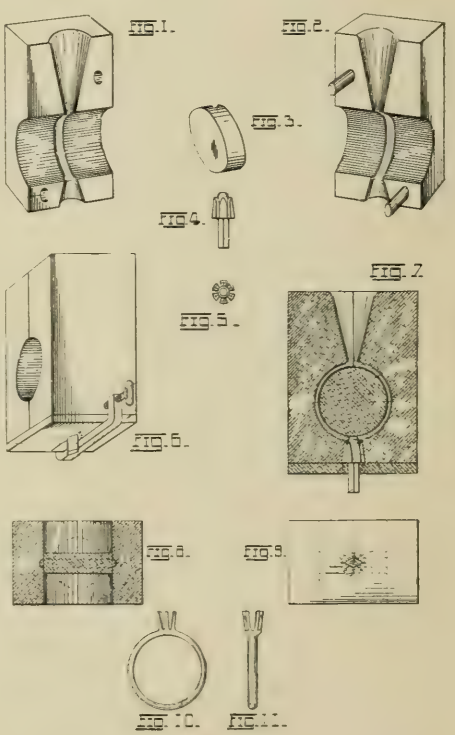
Trolley wheels seem to give better results when made of bronze containing no lead.

As far as known, sodium cyanide gives equally as good results in electroplating as potassium cyanide. Up to the present time, no objection to the use of sodium cyanide has been found.

Fire cracks in rolled or drawn brass may be caused by the presence of bismuth although this metal is rarely present in sufficient amount to cause it. The usual cause is the strain set up in annealing by the unequal working of the metal during the previous rolling or drawing.

Casting Gold Rings in a Permanent Mold.

A method of casting gold rings in a permanent mold has been invented and patented by Adolph Herman of St. Louis, Mo. The material employed is gas carbon, which, the inventor says, is compact and practically indestructible. The central or disk core, however is composed of powdered or crushed carbon or charcoal so as to allow shrinkage to take place and the escape of gases. This may be renewed from time to time.



Method of Casting Gold Rings in Permanent Mold.

The mold, as shown in the illustration, is cut from a solid block of carbon, and is made in halves so that they can be clamped together for pouring. The carbon is now employed extensively for motor and dynamo brushes and is easily obtained. The illustration shows the manner of making the mold.

An Interesting Test of the "Steele-Harvey" Crucible Furnace.

A recent test of the "Steele-Harvey" crucible melting furnace at the foundry of the Buckeye Iron and Brass Works, Dayton, Ohio will prove of much interest to those who are interested in brass melting. This test was made on a 1911 model No. 60 stationary furnace beginning Friday, Apr. 28th. The start was made on a cold furnace and ended at 11:20 A. M. on the 29th. The test occupied a full working day of 9 hours. The following is the result obtained:

Heats	*Metal In*	*Metal Out*	*Loss*	*% Loss*	*Time of Melting*
1	184½ lbs. Phosphor	180 lbs.	4½ lbs.	2.44%	65 min.
2	187 lbs. Red	186 lbs.	1 lb.	0.53%	55 min.
3	175½ lbs. Red	173½ lbs.	2 lbs.	1.14%	45 min.
4	136 lbs. Red	134 lbs.	2 lbs.	1.47%	35 min.
5	182 lbs. Phosphor	178 lbs.	4 lbs.	2.14%	65 min.
6	178½ lbs. Red	175 lbs.	3½ lbs.	1.96%	48 min.
7	180 lbs. Yellow	175½ lbs.	4½ lbs.	2.50%	56 min.
8	170 lbs. Al. Bronze	162½ lbs.	7½ lbs.	4.41%	43 min.
9	179½ lbs. Red	177 lbs.	2½ lbs.	1.39%	40 min.

Separate oil tank was used for this purpose and the oil measured accurately for the day's run.

Total Weight of Metal Melted ... 1573 lbs.
Total Amount of Oil Used ..... 31.55 gals.
Average Amount of Oil Used per 100 lbs., ... 2 gals.
Average Per-Cent Loss on Day's Run 2.1%

The average per cent loss on day's run included all the kinds of metal melted. The nine heats were run inside the regular 9 hour working day, and in all but three cases from 4 to 6 ingots of copper were melted with each charge. The balance was borings, gates and scrap.

In melting metals in crucibles, the ingots or other large pieces should not be packed too tightly in it or they will break the crucible when expansion by the heat takes place.

In making nickel anodes of the best grade, it is customary to melt the nickel twice in order to introduce the right amount of carbon. Carbon seems to be necessary in a nickel anode and must be in the combined and not in the graphitic form.

So-Called "Nickel-Steel" Electrotypes, and the Electrodeposition of an Alloy of Nickel and Iron.*

By the advent of the process of the deposition of the so-called "nickel-steel" shells and the production of the "indestructible hard-steel electrotypes", quite a furore has been created in the electrotyping industries throughout the city of New York, and it will no doubt have its effect all over America, possibly reaching the other side of the ocean. Many printers are demanding the so-called "steel electro", even though they anticipate printing a limited number of copies from the plates.

There is no doubt but what these so-called "steel electrotypes" will outwear many of the copper electrotypes, simply because it is not always the hardest (deposited) copper that is the toughest or that will wear the longest. Neither will the hardest deposits of nickel wear the longest. There is no doubt or contention but what nickel properly deposited will outwear the most reguline deposited copper, and a nickel alloy combining some other metal element to toughen rather than harden the nickel will prove a valuable composition for making electrotype plates for printing purposes, where very large runs are to be taken into consideration solely. For printing qualities or sharpness the copper electrotype is fully equal to any competitor. We have seen electrotype plates, from which 1,250,000 copies had been run, and the plates were at that time in good printing condition, because the copper was of a tough reguline texture and the plates were handled right in making ready and in the printing.

*Abstract of an article in Penrose's Process Annual by George E. Dunton

The so-called "steel" or "nickel-steel' electros are neither steel nor nickel and steel, because steel is a carbonized iron, iron impregnated, or which has absorbed from 0.7 to 2 per cent of carbon. Carbon cannot be deposited in the electrolytic bath because it does not possess the property of replacing hydrogen of an acid to form salts. We feel satisfied that this disposes of the steel part both by itself and in combination with nickel.

Several electrotypers have come out and told the truth about the matter, claiming simply a hard nickel electro or a hard nickel alloy. This alloy is a combination of nickel and iron, deposited probably by the addition of iron sulphate to the nickel bath in a small percentage together wth oxalic acid or oxalate of iron (?).

I do not wish to convey the idea by making the statement that "steel cannot be deposited", or that iron cannot be, for it is possible to deposit a grade of iron so fine and tough that in appearance it is brighter and whiter than steel and possesses superior wearing qualities. Iron is extremely troublesome to deposit, however, for any considerable time on account of the avidity of the solution of iron sulphate for oxygen and the consequent absorption from the atmosphere when the solution has stood for some time in contact with the air. Some of the earlier operators covered the top of their solution with paraffine to protect it from the air. There is no doubt as to the successful possibility of depositing very hard iron; there is some doubt as to the eternal continuation of conditions which will give precisely the desired deposit, for some times the solution will undergo apparently a complete physical change over night and there will be either no deposit at all, or a black powder thrown down in the place of metal. It is then better to make a new solution and start in fresh.

What Watt has said of the composition and working of iron baths, I have found to be true with respect to nickel baths, that "the simpler the composition of the bath, the better the results obtained, and that the weaker solutions yielded not only more uniform results, but more satisfactory qualities of deposited nickel." My best experimental deposits of nickel were produced in a bath of the single salts of nickel without ammonia. The solution stood at 4 degrees Beaumé and I used from 1 to 1½ volts.

There is a peculiar condition attending the deposition of nickel: Whenever the electric current is interrupted, the deposit will be found to lack homogeneity. At or with each interruption, a layer of metal is completed and another layer independent of it forms over it. While there is adhesion between the layers, there is distinction, or, in other words the metal is homologous, but the deposit is not homogeneous. It follows, then that there must be no stoppage of the current while deposition is in progress, or until completion of the deposit, neither should the mold be removed and kept out of the bath for too great a period of time at one and the same interval, or the deposit is liable to form a distinct new layer. The fingers should never touch the surface of the deposit.

Many of the ingredients which find their way into the composition of the plating solution are not accountable for their being there, no plausible excuse can be offered for their addition, and it can only be charged to accident, which is very vividly set forth by a little incident which I hope to be pardoned for relating. A certain workman was facing electrotypes with a certain metal, not steel, and was having some trouble with the deposit coming porous. In his despair he sat down beside the tank and started to clean an old straw hat with oxalic acid, when by some, in this case as it turned out, fortunate accident, the package of oxalic acid was brushed off the edge of the tank into the solution and went into the solution sinking below the surface of the green liquid. But the result he says was almost miraculous; the facings came out without any porosity and he has not had any trouble since. Just what function oxalic acid performs in the plating bath I do not know, but this operator swears by it both for cleaning straw hats and as a valuable adjunct to the deposition of certain metals (not steel). I have devoted considerable time to experimenting with straight nickel baths having an addition of a few of the organic acids recommended by the different works on electrodeposition, citric, benzoic, boracic and phosphoric, but my results were always better by the omission rather than the admission as well as the ammonium sulphate.

If the so-called nickel steel depositing sham has not been already pretty well deflated, there is little doubt in my mind but what it will be after a few of the electrotypes have let the pigs out of their purchase bags and seen what they have in reality bought. If

there is really a demand for electros of a addition or incorporation with the nickel of iron into a deposited shell may prove an advantage, if the electrotyper can secure a proportionate advance for his work, which is doubtful. In reaching a final conclusion to enter into the manufacture of the nickel-iron electros, the electrotyper should consider the fact that the trimming of these plates will be very severe on the cutting edges of all his trimming saws and cutters. The only cutters that can withstand this alloy are the so-called self-hardening steel, and it soon batters down the edges of cutters made of this material. On the other hand, the care and attention which a bath for the deposition of an alloy requires must be carefully considered, especially where iron sulphate is one of the elements. As before alluded to, this salt in solution readily becomes oxidized upon exposure to the air, giving the operator considerable annoyance.

In making up the solution for the nickel-iron alloy, secure the so-called single salts or nickel sulphate, and the common iron sulsulphate. Mix the two sulphates in the proportion of 3 parts of nickel sulphate to 1 part of iron sulphate. Dissolved the mixed salts in water to saturation, that is until the water will dissolve no more. If dissolved in hot water, add an additional amount of water when cold to bring down the solution to 4 degrees Beaumé.

The current must not be carried to the point of producing free hydrogen at the cathode and the bath must be agitated, not necessarily violently, but sufficient to keep hydrogen from collecting over the surface of the mold. The weaker the current, the whiter will be the deposit of nickel, and at the same time the harder and the greater its tendency to curl up at the edges of the shell as it begins to thicken.

To prevent the shells from curling at the edges and leaving the wax, the concerns using this process are resorting to a form of connecting the mold (surface of the mold) to the metallic case, which I was taught when an apprentice boy, thirty years ago. The connections are scraped or dug through the wax to the case, around the four sides of the work, thus holding the edges of the shell firmly or fastening them down to the wax. The back of the case is painted or "stopped-out" by painting it over with hot wax. The connection hole in the case is made bright, and the mold is suspended from the battery rod by an ordinary S hook. By this method and in this bath, shells of solid nickel iron alloy can be deposited heavy enough to back up without the usual re-inforcement of copper.

There is only one real advantage in the nickel iron alloy, made into electrotypes, for very long runs on the printing press, especially of the cylinder types, there is no question but that all of these shells will outwear the copper, we must concede that point. On the other hand, for fine printing or for colored inks, the copper is as good as the nickel-iron alloy. Colored inks are now compounded without the oxides which formerly attacked the copper, and unless the mold from which the shell is made is perfect, it matters little what metal is deposited over the surface of the wax, the reproduction cannot be better than the mold. The great secret of success in plate making, lies not in the kind of metal we are able to deposit, but in the making, and the subsequent treatment of the mold between the pressing and its going into the bath, as well as in the formulating of the molding composition.

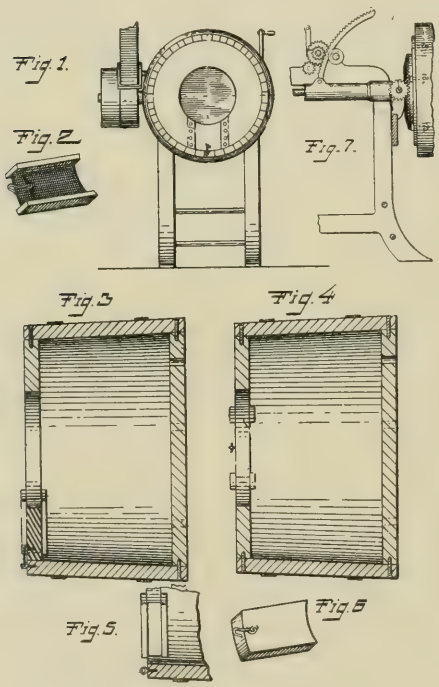
A cheap, gold-bronze mixture for making sand castings can be produced by taking the following: Copper, 45 lbs.; zinc, 55 lbs.; and aluminum, 2 oz. While not strong, it is suitable for many purposes and has a rich color.

Gold for making the finest quality of gold anodes should be practically chemically pure. In the parting of the gold and silver, during the process of making pure gold, nitric acid always gives a purer gold than sulphuric acid as it attacks the impurities better and dissolves them.

A muriatic acid dip for brass, bronze, copper or German-silver, after they have been cleaned preparatory to plating and come from the potash kettle, is excellent and for many purposes is preferable to the cyanide dip. It removes any slight tarnish or stain that has been produced in the potash kettle without attacking the metal. It is particularly advantageous on polished work.

An Improved Form of Tumbling Barrel for Use with Steel Balls.

An improved form of tumbling barrel for use with steel balls has been patented by Herbert A. Johnson and John W. Force of the North & Judd Mfg. Co., of New Britain, Conn., manufacturers of saddlery hardware (U. S. Patent 994,258, June 6, 1911). The object of the barrel is to render the tumbling operation and the delivery of the finished work as easy as possible, and to permit frequent inspection while the tumbling is taking place.



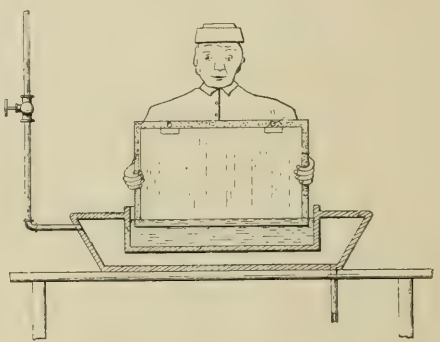
Sketch of the Tumbling Barrel.

The barrel is made of the oblique type, arranged so that it can readily be tilted. It is preferably made of wood or lined with wood so as to prevent abrasion of the work. The hand hole is in the end of the barrel and this may readily be removed. It will be seen that the barrel really combined the advantages of the horizontal and oblique types, so as to give the advantages of both in tumbling.

Method of Treating Electrotype Molds.

A method of treating electrotype molds so that the copper will not deposit upon the back has been patented by George E. Dunton of New York City. In carrying out the process, the same method is used in the beginning as commonly practiced. A pan of shallow nature is made of brass, copper or soft metal and into this melted wax is poured. This constitutes the "case" and the impression of the type, cut or other article is made in it by pressure in a hydraulic or toggle joint press. In ordinary practice this case is then blackleaded and the copper deposited upon it.

In Dunton's process, the case, after the impression has been taken is dipped into a bath of wax so that the back as well as the front



Method of Dipping in the Wax.

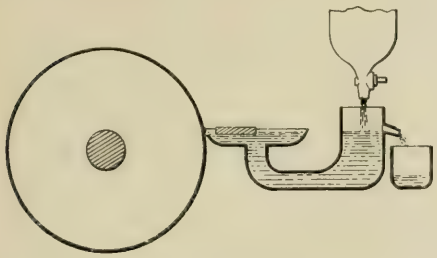
is covered. The connections are made and the face of the case, being the only portion blackleaded, is the only part upon which the copper will deposit. In this manner the rapidity of the electrodeposition of the copper is increased, as it deposits at once on the face; and also there is no waste of copper by its depositing upon portions not desired.

Valve makers should not allow aluminum goods to be made in their foundry, or to use any mixtures containing it. If it is done, aluminum will sooner or later find its way into the valve metal and cause leakage.

Whale-oil soap, fish-soap or plater's soap are the same and are made from fish oils and caustic soda. Any fish oil seems to answer and it is unnecessary to use whale oil as it is more expensive.

Apparatus for Making Fibrous Metals.

In The Brass World, May 1910, page 173 the machine for making fibrous lead at the works of the Ribbon Metals Syndicate of London, England was illustrated. Fibrous lead is now used for many purposes, such as packing and the calking of water pipes. The lead is in the form of fine threads, and by regulating the machine, it may be obtained coarse or fine as desired.



Sketch Showing the Principle of Making the Fibrous Metal.

The company has recently patented their device for making this fibrous lead (U. S. Patent 993,904, May 30, 1911). The principle of the machine may be appreciated by the accompanying sketch. The principle of the process is that the molten lead (or other metal) is fed to the periphery of a rapidly revolving wheel. The wheel practically spins the metal and throws it off in the form of fine threads. By varying the speed of the wheel and the width of the spout at which the metal is delivered the width and thickness of the thread may be adjusted.

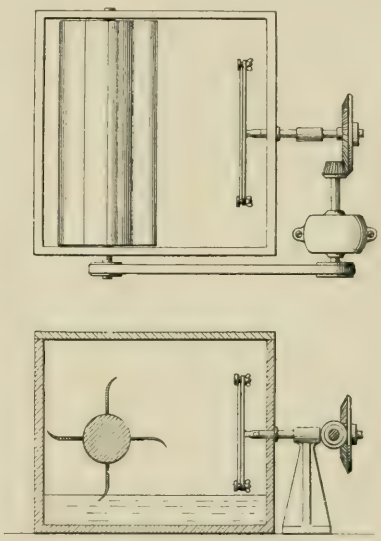
In performing the operation and obtaining uniform results it has been found that the level of the molten metal must be maintained in a constant condition. In order to maintain this level, the constant level device is used. The molten metal flows constantly into the reservoir, and an overflow prevents a rise in the level.

A small amount of tin (from 2 to 5 per cent) is used in making the best quality of lead pipe, or in the manufacture of lead bullets. The presence of this amount of tin prevents, to a certain extent, the formation of the well known white coating on the surface of the lead when exposed to the air containing moisture.

New Form of Etching Machine.

A new form of machine for use in etching metals, particularly in photoengraving, has been invented by Clarence P. Browning of Brooklyn, N. Y. The object is to provide a circulation of the etching solution.

In the etching of copper and brass, it is usually customary to use a practically saturated solution of perchloride of iron. In order to render the etching as rapid as possible, it is necessary to maintain the solution in



The Etching Machine.

constant circulation. This is done to supply fresh liquid to the metal surface being etched. In this invention, the plate is held by clamps inside of a tight box and in a vertical condition. The solution is forced by means of a fan shaped wheel, driven by power, upon the surface of the plate and a continuous supply of fresh solution for etching is thus obtained.

The "fire" in sterling silver is the cause of the lack of brilliancy in the color when buffed. It is caused by the presence of sub-oxide of copper on the surface which penetrates to a considerable depth. It is formed by heating the sterling-silver during annealing in presence of the air. When heated in a neutral or reducing atmosphere, no "fire" is formed.

Questions and Answers.

QUESTION No. 999. What causes spots or pin-holes on nickel plated castings? It is found that when steel is placed in our solution without previous coppering, the surface of the nickel deposit is pitted. When we copper it, however, they are not found. The color of the nickel is good and it buffs well.

Answer. Your nickel solution is too acid. Hydrogen bubbles form on the surface of the steel and cause the pits. The metal cannot deposit where they are. The fact that the steel pits and not the coppered surface is explained by the fact that the solution contains considerable sulphuric acid which acts on the steel giving off the aforesaid hydrogen bubbles. It does not act readily on copper. Brass and copper also pit if the conditions are such as to bring it about. Too strong a current or a solution deficient in nickel will cause it as hydrogen gas is then given off from the surface of the work. Agitated nickel solutions are quite advantageous in preventing pitting as the hydrogen is then forced off from the surface.

QUESTION No. 1000. Is manganese a good addition to yellow brass for rolling? If so what is its effect? An analysis of a sample of brass sheet made in Germany showed a small quantity of manganese which was undoubtedly added intentionally.

Answer. Manganese is an excellent thing in yellow brass when added in the right amount. The quantity added is from 0.05% to 0.10%. Over the latter quantity hardens the brass without causing any additional improvement. Manganese promotes soundness by reducing the oxide in the brass. It also removes sulphur. Brass containing manganese will stand greater punishment in working than that without it. Manganese is the best desulphurizing agent known.

QUESTION No. 1001. What is the advantage of using two cleaning solutions in preparing work for plating? I have been informed that some plating establishments use two cleaning solutions, but I cannot understand why it is necessary. I have never used but one.

Answer. The advantage of two cleaning solutions is that the greater part of the oil and grease is removed from the work to be plated in the first or preliminary cleaning kettle. The other or second solution is kept fairly free from grease. The use of two kettles is quite advantageous in work that is greasy. In the first kettle a suitable soap is generally used, while in the second kettle the regular alkali or alkali compound is used. For work that is only slightly greasy one kettle only is required. When two solutions are used, benzine is dispensed with and the major portion of the grease is removed in the first or soap solution.

QUESTION No. 1002. In casting German-silver in sand, how much aluminum should be used to make sound and satisfactory castings. We understand that aluminum is necessary in it.

Answer. A very small quantity only is required. From 0.05% to 0.10% (1 to 2 oz. to 100 lbs. of German-silver) will give you the desired results. If more than this amount is added, the German-silver will shrink more and cause trouble in casting. A larger quantity gives nothing that cannot be obtained with the small amount.

QUESTION No. 1003. In oxidizing copper with liver of sulphur, what makes the oxidized surface flake off after finishing?

Answer. The flaking is caused by a greasy surface. In order to have the oxidized surface adherent, the work should be just as clean as though it is to be plated. Too strong a solution or carrying the operation too far gives a sooty deposit that rubs off but usually does not flake off.

QUESTION No. 1004. In casting test coupons of manganese-bronze in sand, does the size of the casting influence the strength of the test piece? I have been informed that it does and that the larger the bar the less the tensile strength.

Answer. Yes, the size of the test piece (diameter) does influence the strength and other physical characteritsics. The larger the cross section the lower the tensile strength. A test bar 2 in. in diameter will show a less tensile strength and elongation than one half the size. The reason is that the larger bar cools slower and thus produces a coarser or more crystalline condition in the metal. Large test bars are not used to any extent at the present time for the reason it has been found that a small one fairly represents the character of the metal and is easier to cast and test.

QUESTION No. 1006. Would you advise the use of a forced draft in a small brass foundry? It has occurred to us that it would be a good thing for coke furnaces. We have three furnaces taking No. 30 crucibles and have abundant power.

Answer. We always recommend the use of an auxiliary forced draft in small brass foundries. As a usual rule the draft in a foundry such as yours is rather light, and while there may be ample draft in good weather, it frequently happens that the fires will not melt the metal with sufficient rapidity during damp days. The use of a very light blast produced by a fan is always a great help during such weather. Those who use the blast find it very advantageous under such conditions. It is not necessary to use it every day, but only when the draft is poor.

QUESTION No. 1006. What is the best kind of nickel anodes to use? We have always used the grade known as "90% to 92% Nickel", but do not know that they are better for our work than other grades.

Answer. If you are plating brass or copper,

you will find the 90% to 92% grade very suitable. It is the grade more generally used than any other. Whatever grade you use, however, costs you only for the nickel in it and you pay for nothing else. We recommend the grade you are using and should not change.

QUESTION No. 1007. What is the reason that fulminate of gold is used in gold plating? Is it preferable to the chloride of gold?

Answer. The fulminate of gold is used in a gold plating solution for the reason that it can be added from time to time to replenish the solution with gold without introducing any foreign material. When chloride of gold is used, chloride of potassium is always formed in the solution by the reaction between it and the potassium cyanide used As it is necessary to add some gold compound from time to time to a gold plating solution to make up for that deposited, the addition of the fulminate introduces nothing but gold and a slight amount of ammonia which is soon expelled by the heat.

QUESTION No. 1008. I desire to alloy a 15% German-silver with cadmium, but am having trouble. Although I heat the cadmium before adding it, there is a violent chemical action which throws the metal from the crucible when it is introduced. How can it be used without causing this trouble?

Answer. As cadmium volatilizes at such a low melting point (much lower than that of zinc) there is a violent action when it is introduced into the German-silver. Still, if you add a small quantity at a time and plunge down under the surface of the metal, the action will be less. There will still be some loss, however, and a far better method is to first alloy the zinc, used in the German-silver, with the cadmium and in this manner the difficulty of volatilization will be overcome. As we do not know how much cadmium you desire to use, we cannot advise the proportions of the zinc and cadmium alloy, but you can easily ascertain it yourself.

QUESTION No. 1009. What is the most up-to-date brass solution? I have some fairly good formulas, but no doubt there is something better. I desire one that will give a smooth and heavy deposit.

Answear. To give an exact formula for a brass solution would be to give one that could not be relied upon to work satisfactory. This is caused by the fact that cyanide always varies, carbonate of copper and carbonate of zinc also vary to a considerable extent. Were every ingredient chemically pure, then an exact formula could be given. While chemically pure materials can be obtained, they would be too costly to be used in practice. The most satisfactory method, and one used by all good brass platers, is to first make up a good cyanide copper solution that will give a nice, smooth copper deposit. This is made up of cyanide and copper in the regular proportions. Then make a solution by dissolving 1 lb. of cyanide in a gallon of water. Then dissolve in it all the carbonate of zinc it will take up. To the copper solution, add the zinc solution a little at a time and thoroughly mix. Then try it on a piece of work. At first, when a small quantity has been added, a bronze deopsit will be produced. Then, after more has been introduced, a green brass will be produced, next a full yellow brass will arrive, and finally, when a greater quantity has been used, a gold yellow. In this manner, any shade may be produced. If, on running the brass solution, the color becomes too red, then the stock zinc solution can be used for feeding it.

QUESTION No. 1010. We have a difficult problem to solve. We are obliged to make some castings that will be fairly stiff, easily machined and will *not* amalgamate with mercury. We have tried pure copper, using iron to stiffen them, and a small amount of copper and lead, but we cannot produce a casting that will not break easily after it has been amalgamated. What mixture can be used?

Answer. You cannot use any mixture with a base of copper, as mercury amalgamates with it and penetrating the pores, renders it brittle. Cast-iron or steel will not amalgamate with the mercury and we fear you will have ot use it.

QUESTION No. 1011. Is it possible to produce a *genuine* "Bower-Barff" finish on brass? If so, how can it be done?

Answer. The genuine "Bower-Barff" finish can only be produced on iron or steel. It cannot be produced on brass or anything else. It is produced by heating the iron or steel to a red heat in an atmosphere of steam, and a black color is produced on the surface by the formation of the magnetic oxide of iron. You will readily appreciate, therefore, why it cannot be used on brass.

QUESTION No. 1012. What metal can be added to an alloy of 60% of copper and 40% of nickel, which will give it a spring temper when rolled into sheet or drawn into wire?

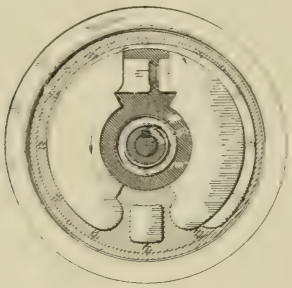
Answer. You can add either iron or chromium. Either will probably give the alloy the temper you desire. We do not know exactly how much temper you desire, but think you will find a few per cent of either ample, and in the case of chromium probably much less on account of its greater hardening properties.

QUESTION No. 1014. A small stop and waste cock of yellow brass which we are making, has a small hole in it which shows only when the machine work is done upon it. It has the appearance of a small worm hole. We have tried everything to stop it without success. The pattern is on a plate, half on one side and half on the other. The part of the casting in which the hole is situated is on the bottom of the plate. We send you a casting showing it.

Answer. Inspection of the casting shows that the hole is caused by shrinkage, probably by the use of too small a gate where it enters the casting. The gate may cool first, thus drawing from the casting. The only remedy we can suggest is to make the gate larger so that the casting will draw from it and feed it.

Patent Abstracts.

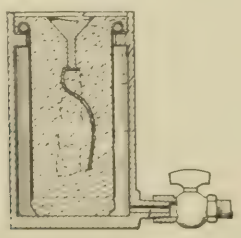
995,548, June 20, 1911. WIRE DRAWING BLOCK. Philias P. Monfils of Worcester, Mass. The object of the block is to avoid the shock taking place when the first pull on the wire through the die is made. By means of



the mechanism employed, the block cannot be started abruptly, but gradually accelerates in speed producing an even drawing without shock. The use of a liquid inside of the block is the means employed and it works upon the principle of a door check.

992,422, May 16, 1911. PROCESS OF PRODUCING LOW CARBON ALLOYS AND METALS. John B. Huffard of Glen Ferris, W. Va. Assignor to the Electro Metallurgical Company of New York City. The process is applied to the reduction of such metals as tungsten, vanadium, uranium, or molybdenum. The oxide of the metal to be reduced is heated with metallic titanium or titanium carbide or nitride. The metal is reduced to the metallic condition and oxide of titanium formed.

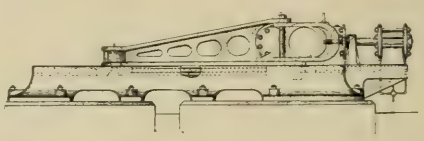
994,225, June 6, 1911. APPARATUS FOR CASTING DENTAL FILLING. Franklin N. Wetherby of Milwaukee, Wis. A wax pattern is made and imbedded in plaster or other



suitable molding material. The air is then exhausted and the molten metal allowed to flow in, thus filling every portion of the mold.

993,776, May 30, 1911. MANUFACTURE OF SILVERED GLASS MIRRORS. Emile Hoorickx of Brussels, Belgium. The process relates to depositing a protecting layer of copper on the silvered portion of a mirror. The copper is plated on the silver by electro-deposition and the feature of the invention lies in the clamp used to hold the mirror while being plated.

995,749, June 20, 1911. BURNISHING MACHINE. Edward R. Williams and George F. D. Rollings of Washington, D. C. A machine for burnishing the portions of an



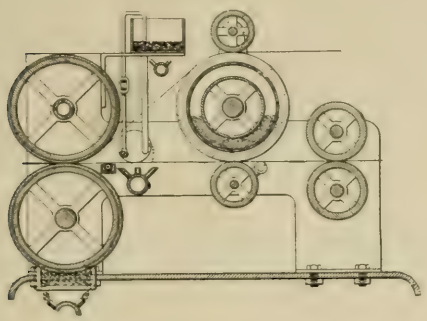
engraved copper plate that is not to print. The burnisher is forced over the surface by suitable mechanism and which constitutes the feature of the invention.

993,391, May 30, 1911. METHOD FOR REDUCING METALS. Robert J. McNitt, of Niagara Falls, N. Y. Assignor to Roessler & Haaslacher Chemical Co. of New York City. A method of reducing sodium from sodium chloride. A lead or tin cathode is used, and the sodium is reduced by the passage of an electric current through the molten salt. The sodium alloys with the lead or tin and then is obtained by distillation in an inert gas.

995,724, June 20, 1911. WHITE ENAMEL. Carl Rosenzweig of Vienna, Austria-Hungary. A superior white enamel is, the inventor claims, made as follows: The silicates of zirconium, thorium, beryllium, lanthannum and didymium are used as it has been found that the mixed oxide can be obtained in a state free from impurities and produce an enamel of better grade than when the silicate of zirconium is used alone.

993,743, May 30, 1911. SAND BLAST APPARATUS. John E. Wright of Wheeling, W. Va. The sand blast has been designed more particularly for removing the rough surfaces from iron castings. The feature of the invention lies in the adjustable nozzles, and in imparting a rotary motion to the article operated upon so that each and every portion may be acted upon.

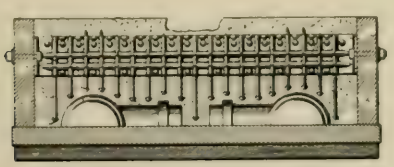
995,586, June 20, 1911. MACHINE FOR SOLDERING METAL PLATES. Henry P. A. A. Eichmann of Corona, N. Y. A machine for soldering copper and steel plates together. Such plates or sheet metal are used in the manufacture of metal encased window frames



and doors. The copper forms the protection and the steel gives the strength. The sheets to be soldered are fed through the machine and rolls carry the flux and the solder, after which further rolling presses the whole together and produces a practically solid composite sheet.

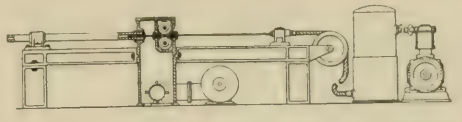
995,298, June 13, 1911. METHOD OF FORMING CLOTH WITH A SIMULATED METALLIC SURFACE. Frank A. Price of Elgin, Ill. The cloth is treated with a mixture of flour paste, soap and white glue, and after drying, the whole is coated with linseed oil and allowed to dry. A mixture of japan and oil is then applied so that it becomes tacky when a bronze powder of any desired kind is applied. Such cloth may be rolled up without danger of cracking and has the appearance of metal.

993,953, May 30, 1911. MOLDERS' FLASK AND BAR THEREFOR.. Royer S. Buch of Elizabethtown, Pa. An improved form of metal bar for use in sand molding. The bar is provided with holes (the bar is made of



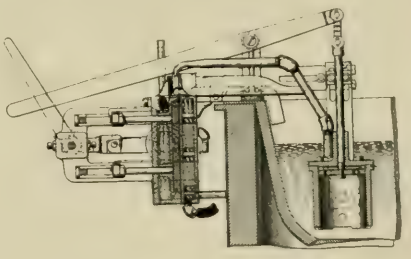
sheet steel) into which nails may be driven so that their length may be varied. These nails then act as the sand support and may be varied to suit any kind of a pattern.

993,631, May 30, 1911. METHOD OF MANUFACTURING HOLLOW METAL RODS, BARS, AND THE LIKE. Arthur Young and Thomas Rowlands of Sheffield, England. The method is used for producing small hollow rods, and although applied to all



metals, is adapted more particularly to the making of steel drill rods. A hollow rod is rolled down while hot and compressed air forced into the hole in the center while the rolling is taking place, thus preventing its closing.

992,853, May 23, 1911. INGOT CASTING MACHINE. George M. Clark Jr. of Lynn, Mass. An apparatus for casting ingots of linotype metal, stereotype metal or other soft



metals. The metal is melted in an iron pot and then forced, by means of a pump, into the molds. The molds are water jacketed and closed so that the ingots are not only uniform but smooth on all sides.

993,338, May 30, 1911. PROCESS OF REDUCING METALLIC OXIDES OR OTHER COMPOUNDS OF VANADIUM, MOLYBDENUM, TUNGSTEN OR SIMILAR METALS AND OF PRODUCING ALLOYS OF THESE METALS. Metallic manganese is used as the reducing agent and the oxide of the metal to be reduced is heated with it, together with a flux.

995,568, June 20, 1911. TUBE BENDING APPARATUS. Geo. H. Reynolds of Mansfield Depot, Conn. Assignor to the General Fire Extinguisher Co. of New York City. The object of the apparatus is to prevent the cracking or fracturing of the tube when it is being bent. The tube is bent around guide blocks operated by hydraulic pressure so that any tendency to flatten at the bend is offset.

Trade Items.

The Tennessee Stove Company of Chattanooga, Tenn., manufacturers of stoves, have had plans drawn for a new nickel plating department.

The Wright Chemical Co., 38 Park Row, New York City, with works at Kenilworth, N. J., are prepared to supply lacquer manufacturers with nitro-cellulose (soluble cotton) for the manufacture of lacquer.

At the Railway Master Mechanics' and Master Car Builders' Convention held in Atlantic City, N. J. on June 14-21, the Coe Brass Mfg. Co., of Torrington, Conn., had an extensive exhibit of extruded metals in a great variety of forms for use in car trimmings, ornaments and for structural work.

Albert F. Shore of the Shore Instrument & Mfg. Co., 555 West 22nd. St., New York City, has been awarded the John Scott Legacy Medal and Premium by the Franklin Institute for the invention of the scleroscope for testing the hardness of metals.

The Chase Rolling Mill Co. of Waterbury, Conn., manufacturers of rolled brass, are sending out a circular to the trade stating that their base price for brass sheet, wire and rod of 13¼ cents per lb., effective June 15th, has been withdrawn as their competitors have announced a lower price under date of July 1st.

The new plating room of the Ontario Silver Co., Muncie, Ind., has been completed and is now ready for occupancy. It has not yet been equipped and it is expected that all the machinery and appliances will be ready before Sept. 1st. The manufacture of silver plated flat-ware and cutlery is carried on by the company.

The Consolidated Casting Co., of Mechanicsville, N. Y., have gone into bankruptcy and Leonard F. Lynd has been appointed receiver to temporarily continue the business of the company. This company was recently organized and was the result of the consolidation of the W. F. Greene Co., of Mechanicsville, N. Y., and the Turnbull-Smith Co., of Syracuse, N. Y., manufacturers of stove trimmings, metal specialties, and also brass founders and electroplaters.

The Artistic Bronze Co., of South Norwalk, Conn., manufacturers of cabinet and builders' hardware, cast brass and furniture trimmings, have, as announced in our June issue, purchased a tract of land on Fairfield Ave., Bridgeport, Conn., and will erect a new plant upon it. Plans are now being prepared and the factory is to cost about $10,000. The contracts have been let and work commenced. The location is on Fairfield Ave., near the west end railroad crossing of the N. Y. N. H. & H. R. R. A new brass foundry and plating room will be built. The business will be removed from South Norwalk, Conn., to Bridgeport, Conn., when the new plant has been completed.

J. M. Betton, manufacturer of the Drucklieb Injector Sand Blast, has moved his office from 178 Washington St., to 14 Park Place, New York City.

C. Roese & Co., manufacturers of ecclesiastical metal work, art metal workers, electroplaters, gilders and brass finishers, have removed from Clarke St., to 101 Barrow St., New York City.

The Precision Die Casting Company are now manufacturing die-castings for the trade. Their plant is located at 424 South West St., Syracuse, N. Y., and a specialty is made of die-cast bearings in white brass and babbitt-metals.

The Imperial Mfg. Co., of Warren, Pa., manufacturers of saddlery hardware and metal specialties, are to establish a Canadian factory in Welland, Ont. A site has been purchased at Patterson Ave., and Major St., and the construction of the necessary buildings will be commenced at once.

The Superior Metal Products Company has been incorporated in Elyria, Ohio, with a capital stock of $15,000 to manufacture stamped metal goods. Electroplating in nickel and brass will be carried on. The incorporators are H. E. Hall, L. H. Lang, L. J. Zeager, M. C. Powers and U. J. Smith. The plant is at Lodi and North Sts.

The Parkhurst Die Casting Machine Co., recently incorporated, have established plants in Anderson, Ind., and in Dayton, Ohio in which die castings will be made. It is the intention of the company to establish plants in a number of other localities. The officers of the company are: President, Winfield T. Durbin; vice-president, Layton M. Parkhurst; secretary and treasurer, William N. Durbin.

It is expected that the new plant of the Vanadium Metals Co., at Groton, Conn., will be ready for occupancy about July 15th. The business of the company will then be removed from East Braintree, Mass., to Groton. The manufacture of large and small castings of vanadium bronze will be carried on and very much increased facilities will be had. This company was the first to use vanadium in the bronzes and have since made a specialty of these alloys for structural work. Victor Lassen is the general manager of the plant.

The Bates & Peard Annealing Furnace Company of Prescott, England, have appointed F. J. Reville, 29 Broadway, New York City, agent for their furnaces in the United States. The New York agency was left vacant by the recent death of C. M. Dally. This company manufacture the Bates & Peard annealing furnace, by means of which it is possible to anneal, copper, brass, bronze, German-silver, sterling-silver, gold alloys without oxidation so that the metal will come out of the furnace in a bright and soft condition which requires no pickling or dipping.

The Bristol Company, Waterbury, Conn., manufacturers of recording instruments, are erecting a two story fire-proof building which is to be used as a dipping department and for oil storage.

Owing to differences having arisen among the partners the United Brass Mfg. Co., of Cleveland, Ohio, manufacturers of plumbers' brass goods, have petitioned the courts for a dissolution.

The Standard Underground Cable Co., of Perth Amboy, N. J., manufacturers of copper and brass wire, insulated wire and cable, have completed plans for their branch plant in Hamilton, Canada. It will comprise of two buildings, 60 x 300 feet and 60 x 150 feet, three stories high and of steel construction.

The Castle Lamp Co. of Amesbury, Mass., are to build a new plant at Elmira, N. Y., for the manufacture of automobile lamps. This company was formerly the Atwood Mfg. Co. The plans for the new plant show a building 60 x 300 feet. The Willys-Overland Company of Indianapolis, Ind., automobile manufacturers are interested in the company. Polishing and plating equipment will be needed.

The New Era Lustre Co., of New Haven, Conn., manufacturers of high grade lacquers, announce to the trade that the recent sharp advance in the price of fusel-oil and amyl-acetate must, of course, necessitate a corresponding advance in the price of lacquer; but as they figure their profit as low as consistent with good business, and their expense is very low, low quotations can be made upon their various grades of products. They state that they desire an opportunity to prove it.

Smith & Richardson, Attleboro, Mass., announce that their "Imperial Polishing Tank" or "Tubbing Machine" is used for tumbling small metal goods, either for cleaning or burnishing them with steel balls. The manufacturer of jewelry, metal novelties, optical goods and other small metal articles will find it a great cost reducer. The machine is fitted with bronze castings and they state it will, therefore, outwear any other polishing tank. The machine is not expensive and can be used by those who desire an economical outfit.

The Niagara Falls Metal Stamping Works of Niagara Falls, N. Y., have let a contract for an addition to their present buildings. It will give them two floors and a basement, each 60 x 100 feet. The basement will contain a fire proof vault for storing dies. Work has already commenced upon the buildings and it is expected that they will be ready for occupancy some time in August. When the new addition is equipped they will have the best of facilities for manufacturing. This will be the third enlargement in seven years. The manufacture of stamped brass, copper, aluminum, tin and other metal specialties is carried as well as jobbing work. House numbers and street signs are likewise made. Electroplating is carried on.

The Menominee Electrical Works of Menominee, Mich., is to start a new department for the manufacture of electric ventilators.

The Buffalo Wire Works Co., Inc., of Buffalo, N. Y., manufacturers of wire cloth and wire goods, are erecting a building 35 x 60 feet, four stories high. The first two floors will be used as offices and the remainder for storage.

The Bontempi Rust-Proofing Company, 111 Broadway, New York City, are to build a new plant in Bridgeport, Conn., for carrying on rust proofing for the trade. This rust proofing process is applied to iron and steel goods of all kinds. The contract for the furnaces has been let to the W. S. Rockwell Co., 50 Church St., New York City.

Owing to the death of H. Hirschbach, proprietor of the U. S. Electro-Chemical Co., 78 Lafayette St., New York City, the business has been discontinued. This company was engaged in the manufacture of various electroplating salts, particularly salts for gold plating and coloring and the trade was carried on more particularly among the small jewelers throughout the country who do electroplating upon a limited scale.

The United States Aluminum Company, 42 Broadway, New York City, announce to the trade that they are prepared to supply aluminum alloys in ingots in large and small lots. Their prices will be found right and they supply the trade with any grade that is desired to meet special or regular requirements. Aluminum ingot consumers should correspond with them before placing orders elsewhere as they desire the opportunity to quote.

The American Manganese Bronze Co., Holmesburg, Pa., and office at 99 John St., New York City, are sending out to the trade a serviceable wallet for pocket use which will prove useful and valuable. Inside the characteristics of the various bronzes made by the company are given, so that one may become fully conversant with what may be done with them, and also what class of goods are made by the company. The wallet is intended for filing private papers and similar uses.

The Davis-Bournonville Company, 90 West St., New York City, have been appointed exclusive selling agents for the National Pneumatic Company and the Davis-Bournonville Acetylene Development Co., for the welding, cutting apparatus and other appliances and processes controlled by these companies. The working capital and executive ability have also been greatly increased. The business of the company has been divided with Eastern office in New York City and the Western Department with the Chicago Welding Department at 515 Laflin St., a division of the National Pneumatic Company. It is expected that this consolidation will greatly increase the development of acetylene welding and cutting.

The Regina Company of Rahway, N. J., manufacturers of music boxes, have commenced the manufacture of vacuum or pneumatic cleaners operated by an electric motor.

The new factory of the Gilbert Mfg. Co., in Toronto, Canada is now completed. The manufacture of metal hollow-ware, nickel plated goods and brass and copper wares will be carried on.

The Acklin Stamping Company, recently organized at Toledo, Ohio have completed a new plant on Dorr St. in that city, and which is now in operation. Stampings of sheet steel, copper, brass, and aluminum will be made.

The Barr Brothers-Rogers Cutlery Co., formerly of Eugene, Oregon, have obtained the plant in Oakland, Cal., formerly occupied by the White Ornamental Iron Co. and will shortly start on the manufacture of cutlery and steel tools on an extensive scale.

J. F. Brown, president and owner of the Ontario Brass & Copper Co., of New Toronto, Canada, has retired from the retail furniture business and will devote his entire attention to the rolling mill. An extensive addition will be made to the plant.

The laboratories of Fitzgerald & Bennie, Niagara Falls, N. Y., have been moved to Highland and Whirlpool Aves., where new and commodious quarters have been obtained. Much better facilities are now had. Research work in electrometallurgy and electrochemistry is carried on.

The new plant of the Baird Machine Co., (now of Oakville, Conn.), in Stratford, Conn., is progressing rapidly and will be completed before the end of the summer. The new plant is located in the main line of the N. Y. N. H. & H. R. R. near Bridgeport, Conn., and is an excellent location for manufacturing.

The Michigan Copper & Brass Co., of Detroit, Mich., manufacturers of rolled brass and copper, wire, rods and tubing. are sending out to the trade their new price list. They have departed from the usual list of the brass trade and have compiled a catalogue which they believe is more convenient than anything that has yet been issued. It is intended for general distribution.

The suit brought by the Globe Machine & Stamping Co., of Cleveland, Ohio, against the Abbott Ball Co., of Hartford, Conn., has been decided in favor of the Abbott Ball Co., by Judge Platt in the United States Circuit Court. The suit was brought an account of the manufacture of the Abbott tumbling barrel by the Abbott Ball Co., after they had assigned interest in the patent to the Globe Machine & Stamping Co. The Abbott Ball Co. set up the counter claim that the Globe Machine & Stamping Co. had not lived up to the agreement in that they had not manufactured the barrel, and Judge Platt so decided the case in favor of the Abbott Ball Co. This tumbling barrel is used for burnishing work by tumbling with steel balls.

The Howe Scale Company of Rutland, Vt., manufacturers of scales, are to erect a new foundry and are making preliminary plans and surveys for it.

The new iron foundry of the Buckeye Iron & Brass Works of Dayton, Ohio, is to be ready about August 1st. It will be 83 x 160 feet.

The Elkhart Musical Instrument Co., has been incorporated in Elkhart, Ind., with a capital stock of $10,000 to manufacture musical instruments.

The damage by the recent fire to the plant of the Star Brass Works Co., 1719 Baltimore Ave., Kansas City, Mo., amounted to about $5,000.

The Buck Plating Company has been incorporated in Great Valley, N. Y., with a capital stock of $40,000 to manufacture plated ware. The incorporators are G. H. Robinson, W. D. Pemberton and E. Ostrander.

The Harshaw, Fuller & Goodwin Co., of Cleveland, Elyria, Ohio and New York City, and Eastern office at Bridgeport, Conn., are sending out a circular to the trade describing the types of Eager dynamos that they handle.

Edwin Pratt & Son, Wire and Iron Works, 165 Court St., Kankakee, Ill., manufacturers of plain and ornamental wire work, are installing a plant for doing hot tinning on their wire goods.

The Hawley Down Draft Furnace Co. of Chicago, Ill., the well known furnace manufactures, have purchased a tract of land in Easton, Pa., and will build a new plant upon it. The tract comprises five acres.

The Lumen Bearing Co. of Buffalo, N. Y., has issued the second series of their booklets on metals. It is entitled "Aluminum" and a history and description of this metal is given in it. The booklet will be sent to those who desire it.

E. P. Webster, 185 Berkshire Ave., Bridgeport, Conn., has started in the manufacture of small metal novelties. Mr. Webster was for number of years connected with the Smith & Egge Company of this city. One of the articles manufactured will be a pencil sharpener of a design not heretofore manufactured. A company called the Weblock Company has been formed for manufacturing the novelties.

The Haas Bros. Supply Company has succeeded the Haas Bros. Co. of Newark, N. J., and has taken over the assets, good will and liabilities of the latter company. The scope of the business will now be increased. Additional capital has been subscribed and influential men have become stockholders and directors of the new company. The management will continue as before. The office and warehouse have been moved to 55-57 Lafayette St. in Newark. The manufacture of buffing and polishing compositions, tumbling and burnishing soaps and compounds, and other specialties for the plating and metal trades is carried on.

The Franklin Boiler Works of Troy, N. Y., are now manufacturing babbitt and bearing metals for the trade.

The Mascot Stove Works, Dalton, Ga., stove manufacturers have increased their capitals tock to $25000 and will enlarge their plant.

The capital stock of the Dalton Adding Machine Co., of St. Louis, Mo., manufacturers of computing machines, has been increased from $1,000,000 to $1,500,000.

The Rome Mfg. Co., of Rome, N. Y., manufacturers of sheet metal hollow-ware, are to build an addition to their plant. It will be 40 x 160 feet and two stories high.

The new plant of the Buckeye Aluminum Co., at Wooster, Ohio is practically completed and will shortly be placed in operation. The manufacture of aluminum hollow-ware is carried.

The Chicago Ornamental Iron Works, 37th. St., and Stewart Ave., Chicago, Ill., manufacturers of ornamental iron and metal work, are to build a two story addition to their present plant at a cost of $30,000.

The H. W. Johns-Manville Co., 100 William St., New York City, have recently placed on the market a new soldering paste called "Solderall." It is put up in collapsible tubes. The flux is incorporated with the solder.

The Canada Metal Co., of Toronto, Canada are now located in their new factory on Fraser Ave. Railway sidings have been laid to the works and the factory is fully equipped with the most modern appliances for the production of their goods.

The Wrought Iron Range Co., St. Louis, Mo., manufacturers of stoves and ranges, have purchased a tract of land, 11 acres in extent along the terminal belt line in that city and will build new shops at an expense of $400,000.

Ernest B. Jackson who, for twenty-five years has been in the employ of the company, has been appointed purchasing agent of the Waltham Watch Co., of Waltham, Mass., to succeed Charles J. Olney Jr. recently elected secretary of the company.

The Sandoval Zinc Company, 410 North Peoria St., Chicago, Ill., are manufacturers of high grade spelter and pig lead to meet all requirements. Their smelter is at Sandoval, Marion County, Ill., and they would be pleased to make quotations for either spelter or lead to meet any desired requirements. Inquiries will be given prompt and careful attention.

Permit has been issued for the new factory of the Artistic Bronze Company at Bridgeport Conn. The plant will be located at Fairfield Ave. and Ash St. and a new brass foundry will be built as well as a new plating room. The company is now located at 13 Union St., South Norwalk, Conn., and the manufacture of cabinet hardware is carried on.

The American Glyco Metal Co., 16th. and Rockwell Sts., Chicago, Ill., manufacturers of babbitt-metals, are to enlarge their plant.

Applications for a Receiver for the Camden Metal Co., of Camden, N. J., brass founders, has been filed with liabilities of $30,000 and assets of $7,500.

The Yale Novelty Co., Leominster, Mass., have brought out a new metal hinge and clask for barettes which, it is claimed, is a radical improvement over anything yet manufactured.

Bakelite, the new material for lacquers, enamels and solid articles, is being marketed in Canada by Plastics, Ltd., 148 Van Horne St., Toronto, Canada.

Paul V. Thiery, formerly of the firm of Wm. B. Kerr & Co., Newark, N. J., manufacturing silversmiths, died in Ridgewood, N. J., on July 2nd, aged 52 years.

The Fort Wayne Electric Works of Fort Wayne, Ind., has been merged with the General Electric Co., of Schenectady, N. Y., and will, hereafter, be known as the Fort Wayne Electric Works of the General Electric Co.

The Canadian Yale & Towne, Ltd., has been incorporated in St. Catherines, Ont., where the new factory of this company will be built. H. R. Towne, J. H. Towne, W. C. Allen, J. B. Milliken, and L. H. Porter are the incorporators and the capital stock is $100,000.

The Ansonia Brass & Copper Co., 99 John St., New York City issue a booklet on Tobin Bronze which will be sent to anyone who desires it, and in which all the information about this non-corrosive and strong bronze is given.

Ernest J. Vatier, gold and silver founder, 30 Franklin St., Newark, N. J., has been arrested upon the charge of embezzling gold from Frisch Bros,. and the Wordley, Allsop & Bliss Co., of that city, and has been held in $1,000 bail. It is stated that he retained gold supplied him for making castings.

The largest radiator in the world has recently been manufactured in Dresden, Germany. It is made of aluminum and is 4 ft. 7 in. square and 8 in. deep. It is to be used on an air ship. It weighs but 145 lbs. and holds 209 lbs. of water. The use of aluminum for a radiator of this kind is something new and has not been tried before. Copper or brass are generally employed, and for air ships, no radiator at all has been employed.

Involving some of the most prominent business men of Seattle, Wash., charges of a conspiracy to defraud the Government of thousands of dollars were recently revealed by the arrest of Emar Goldberg, manager of the Seattle branch of the Great Western Smelting & Refining Co., of Chicago, Ill., W. A. Corder, manager of the W. A. Corder Machinery Supply Co., and Edwin F. Meyer, principal clerk in the office of the general storekeeper at the Navy Yard, Puget Sound, upon indictments returned by the Federal Grand Jury of Tacoma. Bonds were furnished by the three parties.

Current Metal and Supply Prices.

These Prices are net and are for moderate quantities. Smaller quantities command higher prices. Prices subject to fluctuation.

Acetone, pure, 98-99%	lb.	.22
Acid, Acetic, pure, 30%	lb.	.07
Acid, Arsenious (White Arsenic)	lb.	.20
Acid, Benzoic	lb.	.55
Acid, Boracic (Boric), pure	lb.	.12
Acid, Hydrochloric, see Acid, Muriatic.		
Acid, Hydrofluoric, 30%	lb.	.04
Acid, Hydrofluoric, 50%	lb.	.10
Acid, Muriatic, 20°	lb.	.02
Acid, Muriatic, c. p., 20°	lb.	.07
Acid, Nitric, 38°	lb.	.05⅝
Acid, Nitric, 40°	lb.	.05⅞
Acid, Nitric, 42°	lb.	.06¼
Acid, Nitric, c. p.	lb.	.08
Acid, Sulphuric, 66°	lb.	.01¾
Acid, Sulphuric, c. p.	lb.	.06
Alcohol, Wood	gal.	.50
Alcohol, Denatured	gal.	.55
Alum	lb.	.04
Ammonium Sulphate	lb.	.07
Aluminum, Metallic, in Ingots	lb.	.20½
Aqua-Fortis, see Acid, Nitric.		
Ammonia Water (Aqua-Ammonia), 20°	lb.	.04¾
Ammonia Water (Aqua-Ammonia), 26°	lb.	.06¼
Ammonia Water, c. p.	lb.	.08
Ammonium Carbonate, lump	lb.	.15
Ammonium Chloride (Sal-Ammoniac)	lb.	.12
Ammonium Hydrosulphuret	lb.	.30
Ammonium Sulphate	lb.	.07
Ammonium Suphocyanate	lb.	.50
Amyl Acetate	gal.	2.75
Antimony	lb.	.08½
Arsenic, Metallic	lb.	.15
Arsenic, White (Acid Arsenious)	lb.	.20
Argols, White (Cream of Tartar)	lb.	.31
Asphaltum, Commercial	lb.	.05
Asphaltum, Egyptian (Bitumen)	lb.	.30
Benzine	gal.	.15
Benzol, Pure	gal.	.75
Bismuth, Metallic	lb.	2.00
Bitumen, see Asphaltum.		
Blue-Vitriol, see Copper Sulphate.		
Borax, Crystals or Powdered	lb.	.10
Borax Glass	lb.	.35
Cadmium, Metallic	lb.	.75
Carbon Bisulphide	lb.	.10
Calcium Carbonate (Precipitated Chalk)	lb	.10
Chrome-Green	lb.	.50
Copper, Lake, (carload)	lb.	.12¾
Copper, Lake, (cask)	lb.	.13
Copper, Electrolytic, (carload)	lb.	.12⅝
Copper, Electrolytic, (cask)	lb.	.12⅞
Copper, Casting, (carload)	lb.	.12½
Copper, Casting, (cask)	lb.	.12¾
Copper Acetate (Verdigris)	lb.	.35
Copper Carbonate, dry	lb.	.25
Copper Sulphate (Blue-Stone)	lb.	.09
Copperas, see Iron Sulphate.		
Corrosive Sublimate, see Mercury Bichloride.		
Cream-Tartar, see Potassium Bitartarate.		
Cryolite	lb.	.12
Cyanide, see Potassium Cyanide.		
Dextrin	lb.	.15
Emery Flour	lb.	.04
Emery, F F & F F F	lb.	.03
Flint, powdered	lb.	.01
Fluor-Spar	lb.	.01¼
Fusel-Oil	gal.	2.75
Gold Chloride	dwt.	.60
Gum Copal	lb.	.30
Gum Guiacum	lb.	.26
Gum Mastic	lb.	.70
Gum Sandarac	lb.	.35
Gum Shellac, brown	lb.	.50
Gum Shellac, white	lb.	.60
Iron Perchloride	lb.	.25
Iron Sulphate (Copperas)	lb.	.05
Lead Acetate (Sugar of Lead)	lb.	.15
Lead, Pig	lb.	.04½
Lead, Red	lb.	.12
Lead, Yellow Oxide (Litharge)	lb.	.12
Liver of Sulphur, see Potassium Sulphide.		
Manganese, Ferro, 80%	lb.	.10
Manganese, Metallic, pure	lb.	.75
Magnesium, Metallic	lb.	1.50
Mercury Bichloride (Corrosive Sublimate)	lb.	.93
Mercury, Metallic (Quicksilver)	lb.	.44
Mercury Nitrate	lb.	1.50
Mercury Oxide, yellow	lb.	1.80
Nickel and Ammonium Sulphate (Double Salts)	lb.	.16
Nickel Carbonate, dry	lb.	.60
Nickel Chloride	lb.	.50
Nickel Metallic	lb.	.45
Nickel Sulphate (Single Salts)	lb.	.25
Nitre (Saltpetre), see Potassium Nitrate.		
Oil of Vitriol, see Acid, Sulphuric.		
Paraffine	lb.	.15
Phosphorus, yellow	lb.	.40
Phosphorus, red	lb.	1.10
Pitch	lb.	.05
Plaster of Paris, Dental	bbl.	4.00
Platinum Chloride	oz.	25.00
Platinum Metallic	oz.	44.50
Potash-by-Alcohol, in sticks	lb.	.50
Potash, Caustic (Potassium Hydrate)	lb.	.08
Potassium Bichromate	lb.	.14
Potassium Bitartarate (Cream of Tartar)	lb.	.31
Potassium Carbonate (Pearlash)	lb.	.10
Potassium Chlorate	lb.	.15
Potassium Cyanide	lb.	.25
Potassium Iodide	lb.	2.25
Potassium Nitrate (Nitre or Saltpetre)	lb.	.10
Potassium Permanganate	lb.	.17
Potassium, Red Prussiate	lb.	.60
Potassium, Yellow Prussiate	lb.	.24
Potassium Sulphide (Liver of Sulphur)	lb.	.15
Potassium Sulphuret, see Potassium Sulphide.		
Potassium Sulphocyanate	lb.	.70
Pumice, Ground	lb.	.05
Quartz, Powdered	lb.	.01
Rosin, Yellow	lb.	.04
Sal-Ammoniac, see Ammonium Chloride.		
Sal-Soda, see Sodium Carbonate.		
Silver Chloride, dry	oz.	.75
Silver Cyanide	oz.	1.00
Silver, Fine	oz.	.52⅝
Silver Nitrate, crystals	oz.	.50
Soda-Ash	lb.	.05
Sodium Biborate, see Borax.		
Sodium Bisulphite	lb.	.15
Sodium Carbonate (Sal-Soda), crystals	lb.	.02
Sodium Hydrate (Caustic Soda)	lb.	.05
Sodium Hydrate (Caustic Soda) by Alcohol (in sticks)	lb.	.45
Sodium Hyposulphite ("Hypo")	lb.	.04
Sodium Metallic	lb.	.90
Sodium Nitrate	lb.	.05
Sodium Phosphate	lb.	.09
Sodium Silicate (Water-Glass)	lb.	.04
Soot, Calcined	lb.	.15
Spelter, see Zinc.		
Sugar of Lead, see Lead Acetate.		
Sulphur (Brimstone) in lump	lb.	.05
Tin Chloride	lb.	.43
Tin, Metallic	lb.	.46⅝
Turpentine, Venice	lb.	.35
Verdigris, see Copper Acetate.		
Water, Distilled	gal.	.15
Water-Glass, see Sodium Silicate.		
Wax, Beeswax, yellow	lb.	.45
Wax, Carnauba	lb.	.70
Whiting (Ground Chalk)	lb.	.02
Zinc Carbonate, dry	lb.	.19
Zinc Chloride	lb.	.12
Zinc, Sulphate	lb.	.06
Zinc, (spelter)	lb.	.05¾

THE BRASS WORLD AND PLATERS' GUIDE

VOL. VII. BRIDGEPORT, CONN., AUGUST, 1911. No. 8.

A MONTHLY JOURNAL DEVOTED TO THE ART OF REFINING, ALLOYING, CASTING, ROLLING, FOUNDING AND ELECTRO-PLATING OF ALL THE NON-FERROUS METALS AND THEIR ALLOYS.

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ERWIN S. SPERRY . . . . . EDITOR

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Vanadium in the Bronzes and Brasses.

While the value of vanadium in steel has been so thoroughly demonstrated that its use is now quite extensive and it has been instrumental in producing a structural material in the steel that has heretofore been impossible to obtain, the actual value of vanadium in the non-ferrous alloys, such as the bronzes and brasses, has not been fully worked out.

It does not follow, of course, that analogy can be taken into consideration in comparing the ferrous and the non-ferrous alloys as it frequently happens that the good effect of an element in steel may have a different influence on the non-ferrous alloys or metals. We will not say that this is true as far as vanadium is concerned, but so far it has not been demonstrated that this metal imparts to the brasses and bronzes any remarkable qualities. Such a condition, however, may be caused by the fact that very little investigation has been made in the field and it is quite probable that the future will find many new discoveries of value.

One of the reasons for the lack of knowledge regarding the effect of vanadium on the non-ferrous alloys, is that it is has been impossible to obtain any vanadium alloy, by means of which the vanadium could be introduced, free from aluminum. The usual method of introducing the vanadium is by means of cupro-vanadium, an alloy of copper and vanadium, and this always contains some of the aluminum used in reducing the vanadium from its oxide. Pure vanadium cannot be obtained, and could it be obtained, its melting point is so high that it could not be used.

There is so little known in regard to the effect of vanadium on the non-ferrous alloys that a large field for investigation is open, and when carried out the results will undoubtedly show some interesting properties, at least, and probably valuable ones.

Lacquering Machinists' and Carpenters' Tools.

It is with pleasure that we notice the increasing practice of lacquering machinists' and carpenters' tools. It is one of the practices that should have been extensively carried on before but like many other changes of a similar nature, it has been slow to become a general custom.

The majority of machinists' and carpenters' tools are sold with a bright finish. This finish, of course, must be preserved, both while in stock at the factory of the maker, and at the store of the hardware dealer. It has always been the custom of such manufacturers to coat such bright tools over with grease in order to protect them from rusting. While efficacious (provided the grease is of such a character that it will not rust the steel itself) the tools thus covered are not only unsightly, but cannot be handled by the customer without soiling his hands. In other words, the use of grease on the polished steel work is quite unsatisfactory.

When lacquer is used for coating the bright steel goods, it not only protects the steel from rusting, but leaves it bright and clean. There are few customers that would really know that lacquer had been used on the goods. The tools are left in an ideal condition for displaying in a hardware store as they remain bright indefinitely and the lacquer, being so thin, does not interfere with the working qualities.

Dipping, brushing or spraying may be employed for the application of the lacquer and about the only thing necessary to bear in mind, when using lacquer on steel tools, is to use one that is adapted for the steel and does not change the color of the metal when applied. In other words, the steel must not indicate that lacquer has been applied. Many of the large hardware manufacturers are now using lacquer on their fine steel tools, where heretofore grease was used.

Obtaining a Bright Color on Bronze and Composition Castings.

As many bronze or composition castings are found in the trade with a bright, clean color, brass founders frequently desire to obtain a similar color. This color is particularly noticeable on the best grade of steam metal goods, and many persons believe it is obtained by means of an acid dip. This is not the case, however, and such a dip is generally unnecessary.

The color on bronze and composition castings is obtained quite readily by plunging them into cold water when they are dumped from the sand mold and are hot While a simple operation, there are a number of conditions that must be realized before the clean, bright color can be obtained. These conditions are as follows:

The bronze or composition must be of good quality. If it contains too much lead or iron, antimony or other impurities the color cannot be obtained. This is the principal reason why the average brass founder cannot obtain the desired color on his work. The metal is not suitable for the purpose as it usually contains too much lead.

The water into which the castings are plunged while hot must be clean and cold. If warm, the color is not as good. If dirty, the color is unsatisfactory. Copper ingot makers have realized this point and by the use of clean, cold water they succeed in producing the beautiful rose-red color found on the best grade of Lake copper ingots.

The heat of the castings, at the time they are dumped must be right. The hotter it is the better, but there is a limit to the heat, of course, as the metal is brittle if handled when it is too hot. Roughly speaking, however, it may be said that when the castings have cooled to a very low red, it is time to dump them from the mold and plunge them in the water. If plunged when they have cooled too much, the color will not be as good.

The plunging of castings in water also serves to blow out the cores and loosen any sand which may adhere to the surface.

The more tin a steam-metal mixture contains, the better it casts. When too little tin is present, the casting shrinks excessively.

Some Observations on the Elastic Limit of Bronzes as Indicated by the "Henning" Recorder.

By Erwin S. Sperry.

The elastic limit of the bronzes and brasses has always been subject to much discussion and determinations by the ordinary means, such as the drop in beam of the testing machine or by the use of dividers, have given results more or less unsatisfactory. In the early days of the bronzes, the elastic limit was never questioned, and although the figures obtained and often published were incorrect, they were accepted for the reason that no one knew any better and there was no occasion for questioning the results. With the advent of manganese-bronze and its extensive use as an engineering material, the question of elastic limit has been of great importance and the lack of sufficient knowledge in regard to it has often resulted in the rejection of castings or ingot metal when it should have been accepted. The question of elastic limit, while not of so much importance in considering the constructive qualities of bronzes, is really more perplexing than any other physical property for the reason that the "personal equation" has entered in its determination to such an extent that the results could hardly be depended upon. This feature has entered the testing of bronzes to such an extent that many specifications have had the matter of elastic limit eliminated from them.

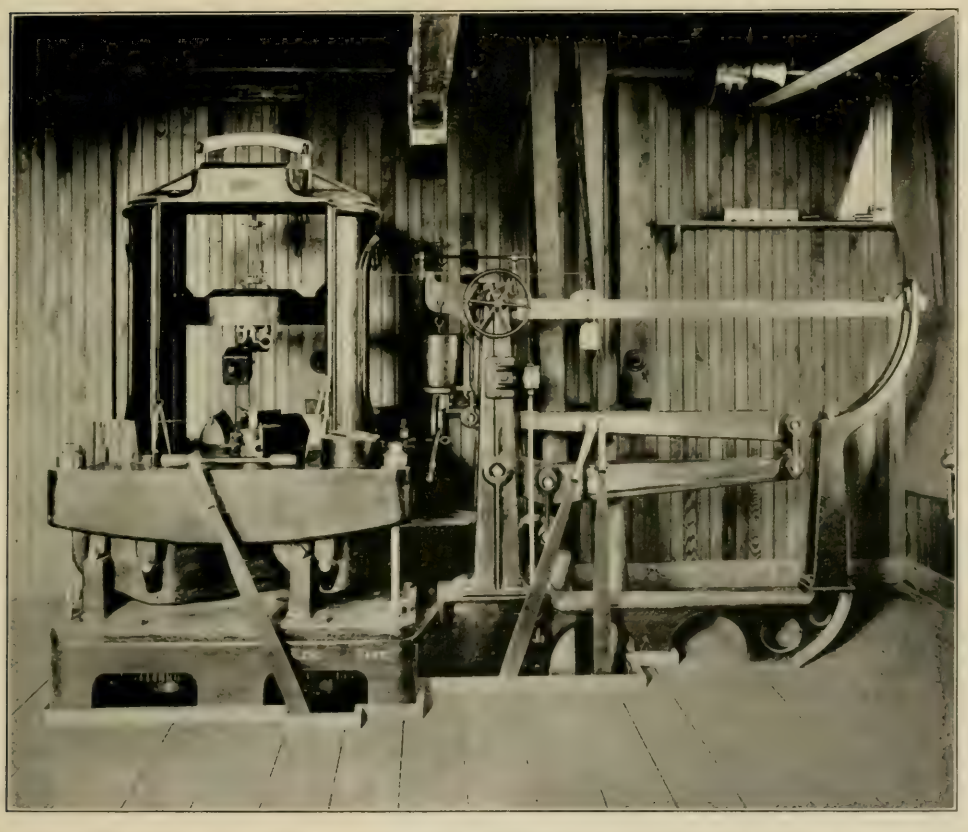


Fig. 1. The Riehle' Testing Machine Upon Which Various Tests Were Made with the Recorder.

The question of elastic limit was brought to the attention of the writer a number of years ago by the great discrepancy of results

when determined by different observers and it was found that in the majority of instances the fault was not with the observers or methods, but on account of the fact that in

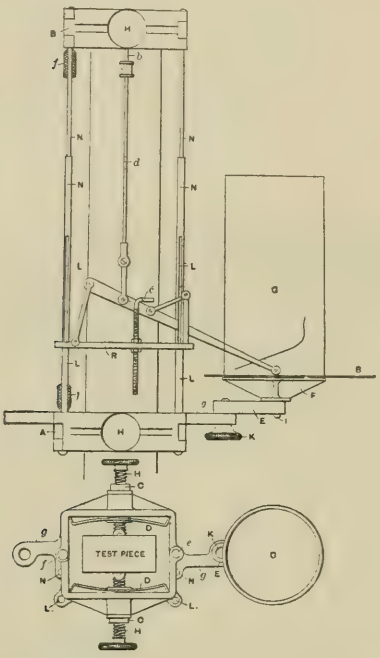


Fig. 2. Sketch, Showing How the Recorder is Made.

many of the bronzes and brasses, there is no well defined elastic limit. This matter appealed to the writer to such an extent that the question was taken up with the late G. C. Henning of New York City, the well known authority on the testing of materials and author of a number of treatises on the subject. Just about this time he had devised an instrument for recording the strain of the material tested and which appeared to be quite well adapted for the bronzes and particularly to the machine used by the writer at that time (a 200,000 lb. Riehle' machine, see Fig. 1). This recorder was described by Mr Henning in the *Transaction of the American Society of Mechanical Engineers,* Vol. 18, May 1897. The instrument is illustrated in Fig. 2.

The recorder is applied directly to the piece to be tested so that the stress-strain is transmitted to it without any additional apparatus. A pointer, upon the end of which a pencil is fastened, records the whole test from beginning to end on a sheet of paper fastened to the drum. This drum is revolved by a cord attached to the weight on the scale beam of the testing machine.

The recorder is made in such a manner that up to the time the elastic limit and yield point are reached, the record made by the pencil is magnified about 5 times, but after this point a hook is situated on the instrument so that, when engaged the record is natural. The multiplying of the tracing beyond the elastic limit and yield point, allows a much better record to be obtained so that the points will be more sharply defined.

This instrument was used in the accompanying tests for the reason that none better was had, but it is believed that it shows the

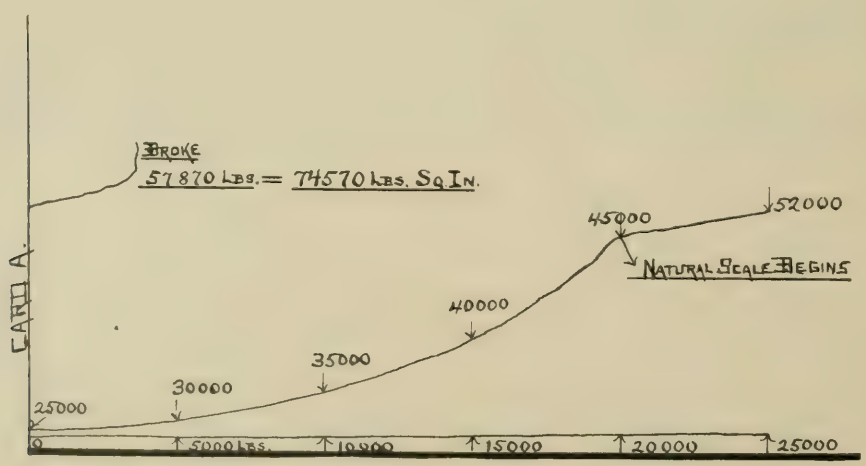


Fig. 3. Record of a 10 Per Cent. Hot Rolled Aluminum-Bronze Rod.

characteristics of the materials tested in an excellent manner and above all indicates that the elastic limit is more or less ill defined in the bronzes. This fact was so prominent that the writer is convinced that the elastic limit in the bronzes and brasses is a matter

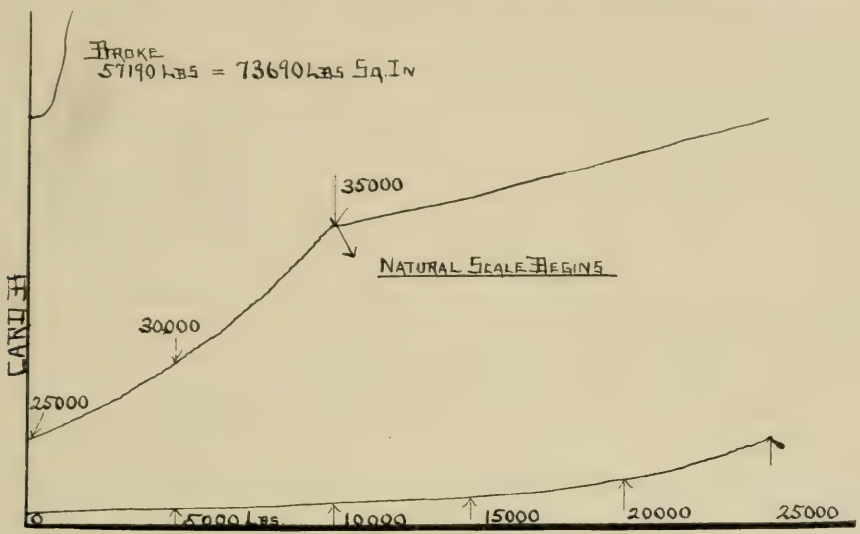


Fig. 4. Record of a 10 Per Cent. Hot Rolled Aluminum-Bronze Rod. Annealed and Allowed to Cool Slowly.

upon which little stress should be laid on account of the difficulty in determining just where it lies. This fact may readily be appreciated by comparing Fig. 6, the results of testing a bar of soft steel with that of Fig. 3,

curve is so gradual that it is impossible to detect where the elastic limit lies

Record Shown in Fig. 3.

This material was a hot-rolled 10% aluminum-bronze rod, 1 in. in diameter. The rod in this test was left as it was hot-rolled. The following analysis was obtained on the rod:

Copper	89.97%
Aluminum	10.03%
Iron	trace
Silicon	trace

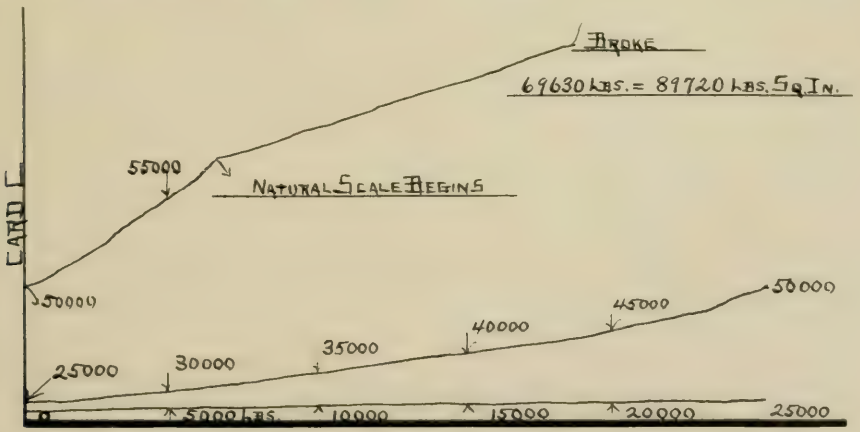


Fig. 5. Record of a 10 Per Cent. Hot Rolled Aluminum-Bronze Rod, Annealed and Quenched in Cold Water While Red Hot.

the results obtained on a bar of hot-rolled 10% aluminum bronze. It will be noticed that the elastic limit is sharp and well defined in the case of the steel, but in the bronze, the

The results were as follows:

Diameter	0.994 in.
Broke at	57,870 lbs.
Tensile Strength sq. in.	74,570 lbs.

Elongation in 8 in. 10.6%
Reduction of Area 14.1%

Record Shown in Fig. 4.

The bar used in this test was cut from the same piece as that used in the preceding test

Record Shown in Fig. 5.

The bar used this test was the same as that of the two previous tests (10% aluminum-bronze, hot rolled), but was heated to a red heat and then quenched in cold water. The results obtained are the following:

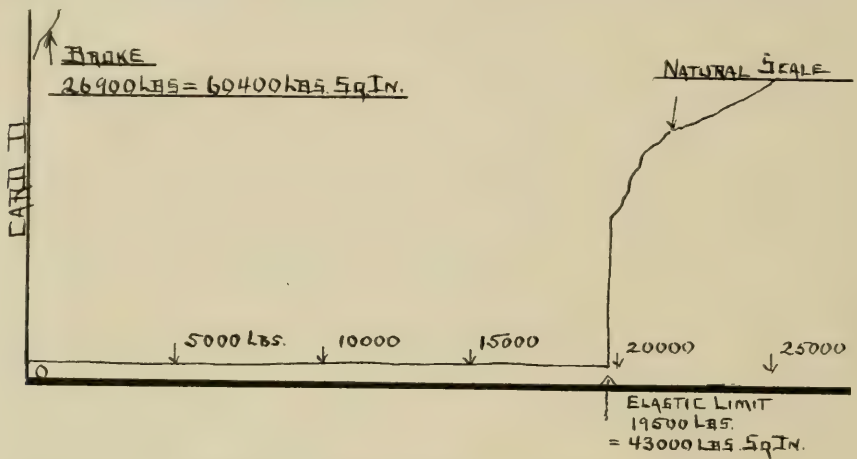


Fig. 6. Record of a Round Bar of Machinery Steel (Low Carbon Steel).

(10% hot-rolled aluminum bronze) but was annealed. The annealing was carried out by heating to a medium red heat and allowing to cool gradually. The results obtained were as follows:—

Diameter ..... 0.994 in.
Broke at ..... 69,630 lbs.
Tensile Strength sq. in. .. 89,720 lbs.
Elongation in 8 in. 12%
Reduction of Area 14%

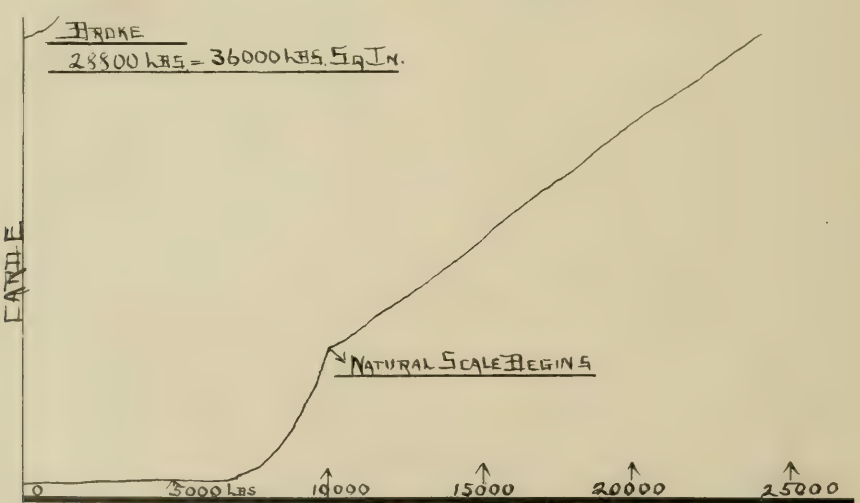


Fig. 7. Record of a Sample of 2 and 1 Cast Brass. Cast in an Iron Mold.

Diameter ..... 0.994 in.
Broke at ..... 57,190 lbs
Tensile Strength sq. in.... 73,690 lbs.
Elongation in 8 in. 18.5%
Reduction of Area 18.0%

Record Shown in Fig. 6.

In order to illustrate the difference in the record between the bronzes and steel, a bar of ¾ round soft steel (machinery steel, so-called) was tested. The results were as follows:

Diameter	0.753 in.
Broke at	26,900 lbs.
Tensile Strength sq. in.	60,400 lbs.
Elongation in 8 in.	31.0%
Reduction of Area	60.4%

When tested the results showed:

Size	0.622 x 1.254 in.
Broke at	28.880 lbs.
Tensile Strength sq. in.	37,000 lbs.
Elongtation in 8 in.	50.2%
Reduction of Area	47.0%

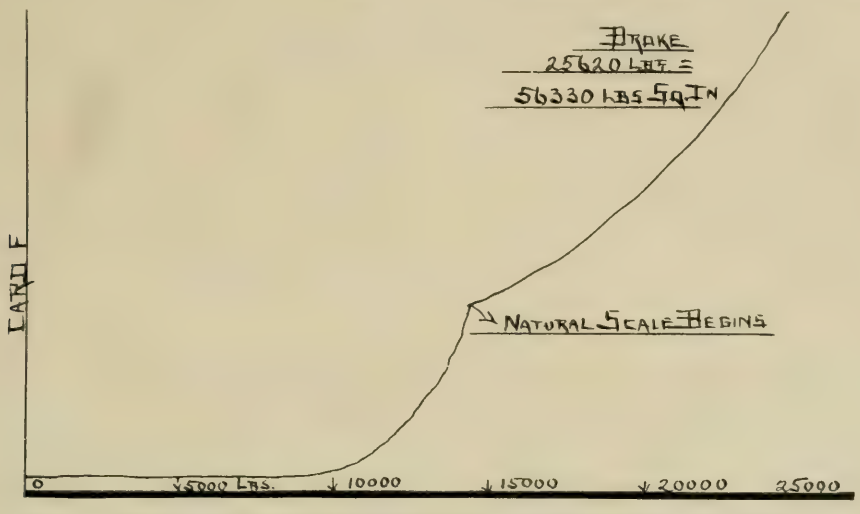


Fig. 8. Record of an Annealed Muntz-Metal Rod. This Rod Had Been Hot Rolled and Then Cold Drawn Before Annealing.

Record Shown in Fig. 7.

A sample of cast brass was tested with the following results This brass was made of Lake copper and Bertha spelter. It was cast in an iron mold on end (like those used for casting brass for rolling). An analysis of the brass gave the following results:—

Copper	66.12%
Zinc	33.78%
Lead	0.01%
Iron	trace
Lead	0.28%
Iron	0.06%

The results obtained on the tesing machine were as follows:

Record Shown in Fig. 8.

An *annealed* Muntz-metal rod was tested with the following results. The rod was analyzed and the following obtained:

Copper	60.51%
Zinc	38.06%
Tin	0.47%

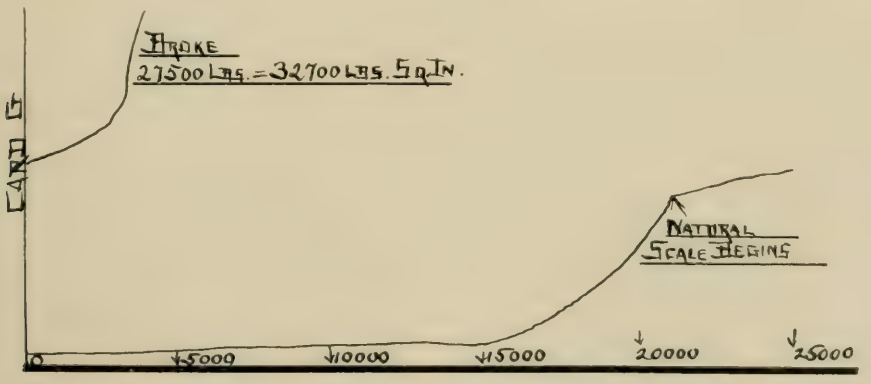


Fig. 9. Record of a Bar of 88-10-2 Gun Metal. Cast in Sand.

Diameter	0.761 in.
Broke at	25,620 lbs.
Tensile Strength sq. in	56,330 lbs.
Elongation in 8 in.	49.2%
Reduction of Area	50.8%

Record Shown in Fig. 9.

A bar of gun-metal was cast in sand. The following mixture was used:

Copper	88 lbs.
Tin	10 lbs.
Zinc	2 lbs.

The bar was cast in green sand and the following results obtained in testing:

Diameter	1.035 in.
Broke at	27,500 lbs.
Tensile Strength sq. in	32,700 lbs.
Elongation in 8 in.	12.0%
Reduction of Area	15.0%

Question of the Elastic Limit.

By referring to the records obtained in testing the bronzes, the ill defined elastic limit is at once apparent. It is almost impossible to detect the point at which it occurs, although seemingly it exists at about the point where the curve begins to change rapidly. This, however, is too indefinite to be of service and when compared with the results obtained on the steel it will be noticed that there is a wide difference.

In the case of the steel, the E. L. is very sharp and exists where the line turns at a right angle to go upwards. Such an abrupt alteration in the course of the line is always obtained on iron or steel and indicates that the elastic limit is particularly well defined. In the case of the bronzes, however, it is not at all apparent.

In testing soft metals, such as copper, soft bronze and some low grade aluminum-bronzes, a little sharper elastic limit could be obtained with the recorder, but not particularly satisfactory. As such materials, however, are never used in any cases where strength and elastic limit are important, the results are of no value. It is the strong bronzes, such as those tested and the records of which were previously given, that are used in engineering, and of which the physical characteristics are important and necessary

It would not be wise, of course, to say that there is no elastic limit in the strong bronzes, as there is apparently a point at which it can be *assumed* it exists; but all that is necessary is to inspect the records previously given in order to realize that the elastic limit is more guess work than anything else. In the writer's estimation, therefore, it is of comparatively little importance in comparison with the other physical characteristics.

A Source of Copper Bearing Material Not Generally Known.

Scrap metal dealers are always on the alert to find sources of copper bearing material not generally known in the trade so that there will not be any competition in its purchase. The majority of sources of such material are from brass foundries, brass rolling mills and other manufacturers of brass or similar metal goods. Such sources are fully known so that the maximum competition exists in the purchase of the copper bearing material which is produced in such establishments.

A source of copper bearing material not generally appreciated is in the manufacture of paper from rags. It is well known that the best quality of paper is made from rags and there is quite a number of such establishments in the United States which produce this kind of material. It has been stated that there are about thirty paper manufacturers making paper from rags.

When such rags are made into paper, they are ground to a pulp and then screened in order to remove the foreign material. It is the foreign material that is the source of the copper. Rags are mainly cast off clothing and such old garments always contain pins in large quantity, buckles, clasps, eyelets, hooks and eyes, and many other kinds of metal goods, the majority of which are brass.

The foreign material thus removed from the rag pulp contains the copper bearing material and large quantities are obtained. To be sure, much of the metal is iron and steel, but these can readily be removed by a magnet machine, leaving the other material in a richer condition. We believe the scrap metal dealer will find this source of copper bearing material worth investigating.

All copper wire is pure, but the best for brass foundry use is trolley wire or large field coils. Fine wire should not be used as it exposes too much surface to oxidation during melting.

The Accurate Determination of Silver on Silver Plated Flat-ware.

It is frequently necessary to determine the amount of silver on silver plated spoons, forks, and other flat-ware articles. These goods are usually made of German-silver unless they are of a very cheap nature when brass constitutes the base metal. This determination is frequently of very great importance in case a dispute is brought up in regard to the actual amount of silver on the goods, and as flat-ware makers guarantee the weight of silver on their goods, a method for the determination of the silver on these articles must be accurate, otherwise it will be of no value.

Fig. 1. Buttons Resulting from the Melting of the Various Kinds of Flat-ware for the Estimation of the Silver.

There are a number of methods which can be employed for the determination of the silver on flat-ware, but each has been open to serious objections in that the results are more or less inaccurate. The method of stripping the flat-ware by "backing-off" in the regular silver plating solution (i. e. using as the anode) is very inaccurate as the German-silver or brass base is attacked when the silver begins to come off from the surface so that by the time all the silver has been removed considerable of the base metal has been dissolved. To be sure, the silver may be determined in the solution instead of weighing the article of flat-ware itself to determine the weight of silver on it by difference, but this is a rather unsatisfactory operation and involves much care, labor and a round-about method to determine the silver. As far as known it has not been used. To determine the silver on a dozen table spoons would mean handling a large quantity of solution, almost too great for accurate work.

The method most frequently employed is to strip the silver in the regular acid strip (consisting of sulphuric acid containing a small quantity of nitric acid) and weigh the article after the silver has been removed. This is the method that has, in the past, been almost universally employed, but it is open to the objection that a small quantity of the base metal of German-silver or brass is dissolved after the silver has been removed so that the results are too high. In other words, more silver is obtained than actually exists on the flat-ware. If the reader will refer to The Brass World, April 1911, page 123, he will find a series of experiments on the subject and in which it was found that when the silver is stripped a slight amount of the base metal is likewise dissolved so that the results are inaccurate. Not very much of the base metal is dissolved, to be sure, if the operation is not allowed to take place too rapidly, but a sufficient quantity is removed, however, to render the results too high.

The suggestion has been made that the silver can be determined in the acid strip and thus no account of the attacking of the base metal need be considered. While this can be done, the determination of a small quantity of silver in such a large volume of sulphuric acid as would be necessary to strip a dozen table spoons is by no means a simple opera-

tion. In addition, sulphate of silver is not entirely soluble in the sulphuric acid so that some precipitate is usually found which, of course, interferes with the ease of determination. When once tried, this method would never appeal to anyone.

Another method frequently tried, but found wanting, is the one which a chemist would immediately evolve, were the problem brought before him for the first time. This is to dissolve the silver from the flat-ware, dilute to a given volume with water, take an aliquot portion of this dilute solution and then determine the silver in it, either volumetrically or gravimetrically. While it would seem a simple operation, it is very troublesome. In the first place, it is impossible to dissolve off the silver with nitric acid without entirely dissolving the whole article. The German-silver or brass, precipitates some of the silver on the surface while the solution is taking place so that in order to remove all of the silver from the surface, the whole article must be dissolved. In case a dozen table spoons are to be operated upon, a very large amount of solution is obtained which is quite inconvenient to treat. The method, therefore, is found wanting.

The Most Accurate Method.

After considerable experience and the carrying out of a number of experiments it was found that the most accurate and satisfactory method for the determination of the amount of silver on flat-ware is to melt the desired number to a button, weigh this button and then drill out 1 gram of chips in which the silver can be determined by any well known method. The amount of silver in the whole button can then be calculated which is, of course, the total amount of silver on the number of pieces of flat-ware used in the test.

Melting.

As the amount of silver is usually desired on a dozen or gross of the flat-ware, it is necessary to operate upon more than one piece. A dozen, however, is usually as large a quantity as can be treated in one batch, and if a gross is to be used, then several separate melts must be made.

The melting is carried on in a clay crucible such as that shown in Fig. 2. It should not be too small. The well known Battersea crucible is quite satisfactory although the Hessian sand or the French clay crucibles may be used. The French sand crucibles are excellent, but are more costly than the Battersea. The Hessian sand crucible is more apt to break.

Bend the handle of the article or cut it up so that the number of pieces will pack well in the crucible. They should not protrude about the top and the best method is to have them well down to the bottom. By cutting the flat-ware into small pieces, this can be done to the best advantage.

Fig. 2. Clay Crucible Used For Melting.

When the pieces have been placed in the crucible, cover with borax to the depth of about an inch or so. This is to prevent oxidation of the metal and produces a clean, solid button.

Melt at a good heat until the borax is fluid and there is no frothing. A small gas furnace is the best for this purpose, although, of course, any method may be used as long as the button is good and clean.

When melted and the borax has become fluid and clear, take the crucible from the fire and allow to cool. Then break it so as to obtain the button (a clay crucible can never be

used but once so that there is no advantage in attempting to get the button out without breaking it). When the crucible has been broken the button and fused borax on it will have the appearance of that shown in Fig. 3.

The button is now removed, the borax removed with a hammer so that the surface is perfectly clean and the accurate weighing carried out. When weighed, the button is drilled and 1 gram of the drillings taken

Fig. 3. Crucible Broken, Showing the Button and Fused Borax.

for the determination of the silver. These drillings are dissolved in dilute nitric acid and the silver determined either by ammonium sulphocyanate (Volhard's method) or by precipitating with hydrochloric acid and weighing the silver chloride. The amount of silver found in this 1 gram, multiplied by the weight of the button, will give the total weight of silver on the pieces of flat-ware melted. This amount of silver, of course, will have to be calculated again as Troy ounces in order to correspond to the trade custom of reporting the Troy ounces of silver on the gross or dozen of flat-ware.

In Fig. 1 are shown a number of buttons obtained by melting various kinds of flat-ware. The large buttons were obtained by melting 1 dozen table spoons, while the small ones were produced in melting 1 dozen teaspoons. The results obtained were as follows:

Heavy Table Spoons	14.04 oz. Silver (Troy)
Heavy Table Spoons	15.12 oz. Silver (Troy)
Light Table Spoons	10.06 oz. Silver (Troy)
Tea Spoons	5.68 oz. Silver (Troy)
Tea Spoons	6.90 oz. Silver (Troy)

Referring to the usual method of determining the silver on flat-ware by stripping in the regular acid strip, and then weighing the article (thus estimating the silver by difference), it may be said that experiments previously mentioned (see THE BRASS WORLD, April, 1911, page 123) showed that the amount of silver obtained by this method is from 5 to 7 per cent too high. While not enough to affect ordinary results, it is sufficient to render the determination inaccurate so that the process will hardly answer in case good results are necessary.

The melting of the flat-ware to a button, drilling a 1 gram sample from it, and then determining the amount of silver in it seems to be the most satisfactory method known and is one that should be used when the most accurate results are desired.

New Books.

HOW TO ENAMEL by Howard M. Chapin. 69 pages, 11 illustrations. 5 x 7½, bound in cloth. Price, $1.00. *John Wiley & Sons, New York.* A well written and quite practical treatise on the art of enameling jewelry, silverware and kindred goods. The various operations necessary for successful enameling are each taken up in separate chapters so that the beginner may fully understand the successive steps required for carrying on the work. The book is written for the practical man and in such a manner that anyone can readily understand it. It will be found useful both to the beginner and the advanced worker.

Fusel-oil, as used in lacquer manufacture, is a by-product in the manufacture of whisky, alcohol and similar spirituous liquors.

Tin can be removed from tin-plate scrap by boiling in caustic soda. The tin in the solution can then be deposited on a sheet iron plate by electrodeposition.

Specifications for Manganese-Bronze.

The Committee on Non-Ferrous Metals and Alloys of the American Society for Testing Materials, has adopted the following specification for manganese-bronze ingots and castings:

MANGANESE BRONZE INGOTS:

GENERAL:

By manganese bronze is meant an alloy containing from 55 to 60 per cent copper, and 40 to 45 per cent zinc with small amounts of iron, tin, manganese, aluminum, etc.

This specification is intended to cover manganese bronze ingots, having notched flat bottoms, approximately 3" thick by 2¾" wide by 12" long, properly tapered to strip easily from an iron mold.

PHYSICAL PROPERTIES:

Ultimate tensile strength not less than 70,000 lb. per square inch.

Elongation in 2", not less than 20%.

TEST SPECIMENS:

The standard turned test specimen, as shown by Fig. 1, page 59, Volume IX, of the Proceeding of the American Society for Testing Materials, ½" in diameter and 2" gauge length, shall be used to determine the physical properties as specified above.

NUMBER AND LOCATION OF TEST SPECIMENS:

One test ingot shall be selected by the inspector to represent 10,000 lb. ingot or fraction thereof. The test specimen shall be cut from one corner near the bottom of the ingot.

In case the test specimen shows a flaw, two additional tests may be selected by the inspector from the same lot, and tested to represent the lot in question.

MARKING:

Each furnace charge shall be kept separate until the lot is sampled by inspector, and each ingot thereof stamped with its proper heat number. When ingot is sampled at destination, various heats can be mixed in shipment, but must be stamped with their proper heat number.

REJECTIONS:

All ingots in each lot will be accepted or rejected upon the physical tests irrespective of the heat or heats from which the test ingots are selected.

The test bar to be used as the standard has the following dimensions: Length over all at least 4¼ inches and to be turned to ½ in. in the middle for a length of 2 inches, leaving the ends ¾ in. in diameter for holding in the testing machine.

MANGANESE-BRONZE CASTINGS.

1. All castings weighing over 200 pounds, with the exception of screw propellers, which have straight surface at least 4½" long and 1" wide, and thickness of at least 3", to have coupon attached 4½" x 1" square, longitudinally to such surface.

2. Castings weighing less than 200 pounds and those not capable of being tested under paragraph 1, should have one test block in accordance with following dimensions, cast with each heat of castings. This test block to be attached to the pouring gate.

3. Each casting classed under paragraph 1 must be numbered, and each heat of smaller castings must be numbered by having the numbers cast on, but in case of small castings this number to be placed on the gate. All castings to be left on the gate until test block has been detached by inspector. The inspector will stamp the test block or coupons with numbers corresponding with numbers of the castings or gate from which they are detached.

4. Test bar of standard dimensions to be same as for manganese bronze ingots. This bar to be cut from coupon, in case of casting weighing over 200 lbs., and from bottom of test block on smaller castings.

5. Metal must be meet the following physical requirements:

Strain per sq. inch in lbs. not less than 65,000
Elongation in 2" 15%

6. Castings must be made in accordance with drawings and specifications, sound, clean, free from blow holes and porous places, cracks or any other defects which will materially affect their strength.

7. In case of propellers, coupons will be attached to hub and to each blade. The coupons will be cast flat on the blade and hub. Those on the blades will be attached one-half distance from root to periphery. Coupons will be cast of such size and shape as may be found necessary to give sound test specimens, and turned down as required under Paragraph No. 4.

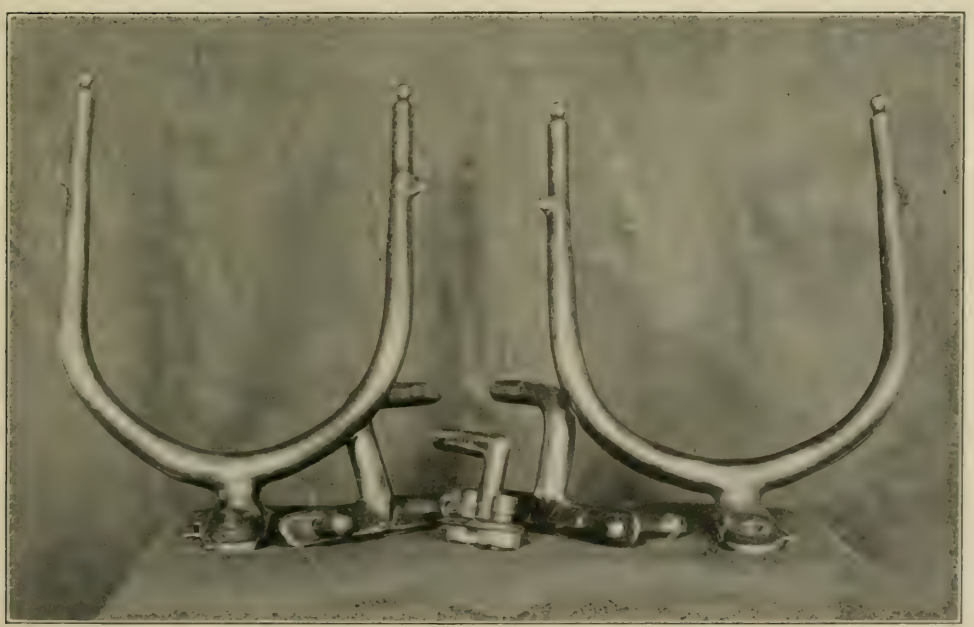
The Cause of Multi-Colored Brass Deposits and How to Overcome Them.

One of the most frequent difficulties found in brass plating, particularly with those who are beginners, is the formation of various colors on the work being plated. The difficulty is quite exasperating and unless the method of overcoming it is understood the problem is apt to be perplexing.

The formation of various colors on the work being brass plated takes place with any kind of metal for the base. It will be found on cast-iron, steel, malleable-iron or any other metal, and the base metal itself has nothing to do with the matter. It also occurs in both hot and cold brass plating solutions, and in addition the quality of the cyanide or the purity of the carbonates of copper and zinc have no bearing on the subject.

The cause of the multi-colored brass deposit is that there is not enough free cyanide in the plating solution. The deposit is accompanied by the coating-over of the anodes. When the anodes remain clean and fairly bright it may be said that the multi-colored brass deposit will not be found, as there is then always sufficient free cyanide to prevent it.

As the absence of sufficient free cyanide in a brass plating solution is the cause of the multi-colored deposit, the condition that is brought about under such circumstances is that the anodes begin to coat over with a



Articles Brass Plated Which, at First, Were "Multi-Colored" on Account of Too Little Free Cyanide; But Changed to an Even Yellow Color When More Free Cyanide Was Added.

Those who have had any experience at all in brass plating are, of course, familiar with the so-called multi-colored brass deposit. For those who are not familiar with it, it may be said that it is simply a brass deposit of a number of different shades. Yellow brass, copper, bronze and zinc deposits are usually present on the surface at the same time, so that as a commercial proposition the work is of no value.

slimy, basic substance so that the passage of the current is impeded. The number of amperes of current flowing is therefore gradually reduced until, perhaps, the anodes become coated over to such an extent that no current at all will pass. During the gradual reduction of the current which passes, there-

fore, the conditions are completely changed. It is well known that to produce a good brass deposit, a higher current density (i. e. stronger current) is necessary than for depositing copper. As the current density begins to fall, accordingly, the color of the deposit begins to change and instead of yellow brass, a number of different colors are obtained depending upon the current strength.

The Remedy.

The remedy for the multi-colored brass deposit is the addition of free cyanide. It is a simple matter to carry out the remedy. Proceed as follows:

Make the following solution:

Water	1 gallon
Potassium Cyanide	2 lbs.

Add this solution to the brass solution, a little at a time, and try it on the work. After each addition of this cyanide solution, however, the whole solution must be thoroughly stirred up to mix it. If the multi-colored brass deposit does not disappear and an even one come, then more of the cyanide solution should be added. Pay no attention, at this time, to the color of the brass deposit as long as it is even. It may be white, but this will not matter as long as it is all of one color.

Continue this addition of the cyanide solution, with trials, until the deposit becomes even and then stop as no more is required. If the brass deposit is then even and of the right color nothing more need be done, but it will usually be found that it is not. The general experience will be that, while the deposit is uniform, the color is not right. It may be a white zinc deposit, in case too much free cyanide has been added, or it may be red or bronze as the conditions bring about. Now proceed as follows:

If the deposit is white, then add carbonate of copper in small quantities at a time until the right yellow brass shade has been produced. If too red, then add carbonate of zinc until the desired color forms. In this manner it is possible to obtain the desired results.

Bear in mind that the formation of the multi-colored brass deposit is produced by the absence of sufficient free cyanide to keep the anodes clean. It is always found that when such multi-colored deposits are produced, the anodes are coated over so that the passage of the current is impeded, indicating that free cyanide is lacking.

Producing a Yellow Gold Deposit.

Platers frequently have difficulty in producing a yellow gold deposit. It usually is found that the color is too red, or "foxy" and the trade is not satisfied with it. What is desired is a color like that of pure gold, free from alloy. On the other hand, a color that is too yellow (on account of the presence of silver) is not always desirable for the reason that it approaches the so-called "lemon" color.

The reasons why platers obtain the reddish gold shade or "foxy" color are as follows:

1. Too much free cyanide is used and this serves to bring on the "foxy" shade.

2. The solution is used too hot. The hotter a gold solution is the redder the color.

3. The current strength may be too high. The stronger the current the redder the gold deposit.

4. The gold is deposited on a red metal such as copper or bronze. Unless an exceptionally heavy gold deposit is put on, the color of the base metal shows through. For yellow gold deposit, the base metal should be of yellow brass in order to obtain the best results.

For producing the yellow gold deposit, the following solution of Roseleur has been found the best:

Water	1 gallon
Phosphate of Soda	8 oz.
Bi-Sulphite of Soda	1¼ oz.
Potassium Cyanide	⅛ oz.
Gold	2½ pennyweights

The gold is dissolved in aqua-regia and made into chloride as free as possible from acid. It is then dissolved in the solution.

This solution is used at a temperature of about 120° F., and if a yellow color is desired, it must be deposited upon yellow brass. When deposited directly upon copper, the color of the copper shows through and a gold with a reddish shade is produced. It might be said that the principal "trick" in the production of yellow gold is to deposit it upon brass and not on a red or a white metal.

For acid metal, which is to stand weak sulphuric acid, such as found in mines, etc., a phosphor-bronze containing no zinc stands quite well. The addition of lead to it increases its non-corrosive properties but reduces its strength.

Some Points on the Design of Aluminum Castings.*

By H. W. Gillett.†

The lightness, beauty and resistance to corrosion of cast aluminum, combined with its good strength in comparison with its weight, are bringing it into vastly increased use in the best modern cars. All automobile castings must, of course, be designed primarily with a view to the fitness for the particular use intended. Usually, however, there are

Fig. 1. The Round Corner, Showing Best Form for the Pattern.

several ways of designing an aluminum casting, any one of which would allow it to serve its purpose well, keep within the weight limit and still be a good proposition from the point of view of the machine shop.

The problem is then to select the best possible design so that the casting may be produced in the best and cheapest way. Luckily the design that allows a casting to be easily and cheaply made is usually one that gives us a casting of far greater strength and reliability than one so designed that it is a difficult one to handle in the foundry. The designer is usually closely in touch with the machine shop and well acquainted with its problems, but seldom, indeed, is a foundry expert; could he realize the extra labor, and hence the extra cost and delay in production, a seemingly slight point in his design may make in the foundry, he would oftener consult with the pattern maker and with the foundryman before completing his design.

Owing to certain physical properties of aluminum, such as its high contraction on cooling and its weakness when just solidified, —that is its hot shortness—aluminum castings require more careful design than almost any other casting metal. If one examines the defective casting records of the individual patterns in a large aluminum foundry, he is struck at once by the vast difference in results from different patterns. Some patterns give uniformly good results, while others differing but slightly from them are extremely troublesome. Speaking broadly, almost fifty per cent of the discrepancies between the number of molds put up and the number of good castings made may be traced to the door of the designer in one way or another, and about twenty-five per cent more may be traced to the door of the pattern maker.

Do not think that we look upon a designer and a pattern maker as the natural enemies of a foundry. On the other hand, they are keen to see that what they can do to aid the foundry without interference with the requirements which the casting must meet, it will come back to them many fold in lower cost and in regularity of delivery. But it so often happens that the automobile engineer will say: "We know that particular design is a poor foundry proposition and that pattern is not made in the best possible way, but we cannot change that model now nor can we tie up production of our cars long enough to allow changing the pattern," that it is worth while to remind you that the time to go into

Fig. 2. The Square Corner, the Wrong Method.

these points is when a new model exists in the mind and on the drawing paper of the engineer, rather than when the car is being assembled.

In passing from the molten to the solid state aluminum contracts a good deal; when a heavy and a thin section come next to each other, as in sample * No 1 (which will be passed around), the thin place will freeze first.

*Paper read at the Meeting of the Society of Automobile Engineers, held in Dayton, Ohio, June 15-17, 1911.

†Operative Manager, No. 1 Plant, The Aluminum Castings Co., Detroit, Mich.

*Samples exhibited at the meeting.

If the thin section is so situated as to lie between a heavy section and a gate or riser the supply of metal is thereby cut off from the molten mass in what is to be the heavy part of the casting. The contraction on freezing has to take place, and instead of taking place uniformly over this heavy part and maintaining the exact shape of the mold, it will often draw away from a corner and produce a "shrink," as in this sample. We can induce the heavy portion to freeze more quickly by placing the chill in the mold at that point (a chill being a piece of some material, usually a metal having a higher heat conductivity than the pot of the mold). It is difficult to accomplish the end completely by this method; it greatly increases the time required to put up the mold and produces unsightly chill marks on the casting.

The ideal casting, therefore, is one of as nearly uniform section throughout as is practical, since that means that the whole casting solidifies at the same time, so that the contraction is uniform. On account of the hot shortness of aluminum the shrinkage strains set up when a heavy section joins a thin one often causes the metal to give away entirely at that point, and a crack appears, as in sample No. 2. Sample-3-A shows this even better.

This was taken from a crank-case containing three braces—two like 3-A and one like 3-B. Those of the 3-A type cracked in a consistent and appalling manner, while the 3-B never gave any trouble. It was finally found that there was no reason at all why all the braces should not be like 3-B, and the designer finally gave permission to have them all made in that way. The defective castings from that cause promptly fell from fully 30 per cent. to nothing. This change meant simply the addition of an ounce of metal to a 48-pound casting. Moreover, this principle can as often be applied to reducing too thick a section as by increasing too thin a one.

If it is inevitable that light and heavy sections come together, the cooling strain should be distributed by joining the sections by a smooth curve, that is, a liberal fillet. This is on account of another physical property common to all molten metals. Suppose we have a sharp corner, as at the vortex of a right dihedral angle. The metal, of course, freezes first at the edge, crystals being deposited which tend to grow inward, as shown in Fig. 1. Each succeeding crystal finds it easier to attach itself to the end of the one previously formed, so that soon a line of crystals has grown by bisecting the angles. Now crystals in regular lines do not form as strong a mass as when they lie interlaced in helter-skelter fashion. It is easier to pull apart a pile of nails lying side by side than one which has been stirred up. On a smooth curve, as in Fig. 1, there is no adventurous crystal which come out first and to which the rest attach themselves like a swarm of bees. The crystals along the curved surfaces come out more nearly at the same time, and the next lot is deposited lying between the first ones in helter-skelter fashion, instead of coming out in a line with the follow-my-leader effect. In other words, a sharp angle tends toward the formation of a definite line of crystals, which form a sort of cleavage plane and is a source of weakness.

A break across a square bar of almost any metal will show distinct lines connecting the opposite corners, showing the arrangement of the crystals in this fashion, while a round bar shows no such lines. From this we can see the necessity of a liberal fillet. The sharper the angle at a change of direction, or the greater the difference of thickness at a change of section, the greater should be the radius of curvature of the fillet. If a second heavy part has a large boss and is near a first, both being joined by a thin section, the fillet should be more liberal than if only one were present. Sample is an example of the lack of fillet at a sharp corner between thick and thin sections. This was the fault of the pattern maker in this instance and are glad to say was speedily remedied.

There is no one factor in foundry practice that more gravely affects the strength of the casting than the pouring temperature. The reason for this is again the speed of crystallization. The cooler the metal can be poured into the mold the more quickly it solidifies and the less time the crystals have to grow or arrange themselves, and the result is a mass of closely interlocking crystals forming a strong, fine-grained material.

The effect of pouring temperature is well shown by this set of test bars (exhibited at the meeting) all of which were cast from the same pot of metal with exactly similar molds, the only variable being the pouring temperature. The bars are arranged in order of the pouring temperature. You will note the rough surface and coarse fracture of the bars cast at the higher temperatures, as well

as their low strength. The average results obtained in this series of tests are given by the curve (not shown here) which shows that lower the pouring temperature the stronger the casting.

This has a distinct bearing on design, since the lowest temperature at which a casting can be poured is that to which the thinnest section will just escape a misrun. If the casting is so designed that this crucial section forces you to pour hot, all of the thicker parts will freeze too slowly and will be weaker than they should be. By slightly increasing the section of the thinnest parts, a casting could often be poured 100 degrees colder and the strength of the whole casting be increased at least 10 per cent. This is a matter which is absolutely up to the designer. If the bulk of the casting is from a quarter to half inch thick, one little part one-eighth of an inch thick will give us a resultant casting, on account of the high pouring temperature required, whose average strength is about 16,000 pounds per square inch, instead of 18,000 pounds or over. The call for lightness has led many designers to overlook this vital point.

The very great influence of the pouring temperature is the reason why separately cast test bars show only the quality of the ingot metal and nothing at all as to the strength of the corresponding casting, even though the test bar and casting may be poured from the same pot of metal. Your Standards Sub-Committee has wisely specified that aluminum test bars shall be made on castings. Were this stipulation not made, the foundryman who wished could pour the casting as hot as he pleases, allow his metal to cool way down and then pour separate test bars which would then show an utterly fictitious strength in comparison with the casting.

The general lack of attention to pouring temperatures, not only in commercial practice but in most of the investigations on aluminum, vitiates a good deal of the published data on aluminum alloys and accounts for a great many irregularities and seeming contradictions in the results. In comparing the different alloys of aluminum, really comparable results can only be obtained by pouring at the same number of degrees above the melting point of the particular alloy in question in all cases, thus allowing the same time for crystallization and producing an analagous condition.

After the designer has done his work, it is up to the pattern maker to decide how the pattern shall be constructed. First of all, the pattern should be made so as to allow the use of molding machines wherever practical. If a pattern maker is not too much bound down by tradition, he can often simplify matters greatly. For instance, in a crank case with several projecting pieces on the side which would make it impossible to draw the pattern from the sand without the use of core work at the sides, by the simple expedient of making the pattern hollow and putting in a lever by which the pieces are drawn into the body of the pattern and the pattern then lifted out, a large amount of core work would be eliminated.

Core work always means trouble. It takes time to set cores in the mold correctly, and if a lot of small cores are used, the danger of shifts is greatly increased. If, on the other hand, large cores are used, they must be hard enough to allow handling them and setting them in the mold, which requires not only a solid core but one reinforced by iron rods and wires. This makes them hard to crush, and on large cores inside of thin walls of metal introduces danger of cracking. When we have a core completely surrounded by walls of metal it is a question whether the tensile strength of the metal as it solidifies is greater than the compressive strength of the core. Let the core be ever so slightly too hard and your casting is inevitably scrap. We have seen patterns requiring large and complex cores within walls as thin as 3/16 of an inch, from which patterns it was absolutely impossible to make castings, since any core strong enough to place in the mold would have too great a compressive strength for the metal to crush without cracking the casting.

If cores must be used, the core prints should be large and deep so as to anchor the cores firmly without the use of chaplets to hold the cores to place, since it is impossible for the molten metal to fuse a chaplet into the body of the casting, without pouring at a temperature far above that necessary to give the greatest strength. When a job requires cores, the first question that should be asked by the pattern maker is if that pattern cannot be made so as to allow the use of green sand core, or at least a green sand half. Green sand will crush and give away when the casting contracts on cooling, where a hard,

dry sand core will not crush and will crack the casting.

The foundry is called upon to make castings of even greater complexity, and the core work required has increased amazingly in the last couple of years. Core rooms once fully adequate for a given molding room are now being overcrowded and unable to cope with the demand for cores. This situation could be greatly improved if the pattern maker would put green sand halves in all castings where it is possible to use them; and the results would be both cheaper and better.

If a considerable number of castings are to be made, wooden patterns and core boxes are an abomination. They warp and swell in use, dry out and crack apart in storage and wear out by abrasion from the sand and by the constant rapping necessary to allow the pattern to be withdrawn from the mold or the core-box from the core. Good metal patterns and core boxes are an economy if many castings are to be made, or if a few are to be made from the same pattern in successive years.

With proper design and a well made pattern the engineer who wants an aluminum casting must next face the problem as to what aluminum alloy he shall specify his casting to be made. He has a choice of practically three alloys—one containing 8 per cent. copper, one with 3 per cent. copper and 15 per cent. zinc, and one with 35 per cent. zinc, designated respectively as alloys Nos. 1, 2 and 3 in the Standards Sub-committee specifications and known to the trade as Nos. 12, 31, and 63. Comparable test bars on these show in the order named—18,000 lb., 22,000 35,000 lbs. tensile strength per sq. in.

Probably 90 per cent. of all aluminum automobile castings are made of No. 12. Though this shows the lowest tensile strength of the three, the trade has come to it for several reasons. First, when aluminum castings are desired, lightness is usually a prime factor, and the zinc-containing alloys, Nos. 31 and 63, are respectively about 7 per cent. and 18 per cent. heavier than the copper containing alloy, or No. 12. The second reason is that the alloys containing zinc are more liable to shrinkage strains, which may develop as draws and shrinks or as hidden strains, which cause cracks to appear after the material has been subjected to vibratory stress, and make the casting liable to fail in service. The strength of the zinc alloys falls off more rapidly with increasing temperature than does that of No. 12, so that the alloys which are stronger at ordinary temperatures, when subjected to the heat developed about a motor, may lose their seeming advantage.

The zinc alloys, moreover, are more brittle and less ductile than the No. 12, as well as more likely to break down in vibration or under repeated impact. Although so eminent an authority as Mr. Souther disagrees with this in a recent article in the Cycle and Automobile Trade Journal, yet there must be a reason for the very marked abandonment of the zinc alloys for the copper alloy throughout the industry. Mr. Souther's figures given in this paper are the same he published several years ago in the Metal Industry, and on looking over the fuller data in this earlier paper it seems to us he must have drawn conclusions from too few tests and probably from tests on bars not necessarily cast at corresponding temperatures.

We expect to go into this matter of endurance of different aluminum alloys more fully in the near future and plan to report the results at a future meeting of the Society. A large number of tests so far have shown that on the White-Souther Endurance Machine the different alloys run about as follows:

No. 12—over a million revolutions.

No. 31—about 600,000 revolutions.

No. 63—about 500,000 revolutions.

before fracture. These are averages of a large number of bars. You will note that the resistance to vibratory stress is in opposite order from that of the tensile strength, but exactly in the order of the ductilities.

On another type of endurance machine where the bar is subjected to repeated blows, we understand the No. 12 will stand about a million blows before rupture, while No. 31 will only stand 1500 to 2000.

The brittleness and unreliability of No. 31 and No. 63 are usually laid to the presence of zinc. On the other hand it is more likely due to the absence of aluminum—that is, alloys high in aluminum are resistant to vibratory stresses, while alloys low in aluminum are less resistant. An alloy containing 88 per cent, aluminum and the rest zinc gives nearly as good results in the endurance test as does No. 12 with 92 per cent of aluminum, but since the tensile strength is decidedly inferior to No. 12, and it is a heavier alloy, this is no longer a commercial alloy.

Magnalium, or 94 per cent, aluminum with

6 per cent. magnesium, is about as strong in tension and has about the same resistance to vibratory stress as has No. 12. To get strength enough to pay for the added weight where zinc is used as the chief alloying metal, we are forced to use so much zinc that the ductility and resistance to vibratory stress are cut far below the figure for No. 12. We really have three factors, strength, lightness and resistance to vibratory stresses. If we give each factor what we might call a coefficient of importance and we multiply the three together, the alloy which gives the highest product will be the most valuable.

The automobile engineer has practically made this calculation and he has answered the question by specifying the 8 per cent. copper alloy in the vast majority of cases.

The engineer who wishes to get good, reliable aluminum castings and at a reasonable price must then realize that the problem is not entirely up to the foundryman to whom he entrusts the pattern, but that it is his problem as well. The responsibility for design is solely his, and if he will so proportion his castings as to avoid great inequalities in section or sharp changes in direction, and if he will use liberal fillets, if he will keep away from such thin sections that the metal must be poured too hot to get strong castings, if he instructs his pattern maker to go as far as he can in avoiding dry sand cores, if he will provide good substantial patterns, will specify the proper alloy and then see that the casting is made with proper care and with proper control of pouring temperature, he will get castings which will allow him to utilize to the fullest extent all the many advantages which aluminum has for his purpose. But he should not for one moment forget that unless the design is right, the best efforts of the foundryman cannot produce a casting which will have in the fullest degree those advantages which the perfect aluminum casting should have.

The designer is father to the blue print—the blue print is father to the pattern—and the pattern is father to the casting. Even though the relationship be remote, the designer should give his great grand children the best possible chance.

Copper is not as poisonous as believed. Those who habitually work with it are not subject to the ills that follow the use of lead or arsenic.

Transparent Enamels on Silver.

By Charles E. Swett.

In the opinion of the writer the most beautiful product of the jewelers' art of to-day is the silverware ornamented with transparent enamel. The work requires as a base, a transparent, colorless enamel of high lustre. Such an enamel is not difficult to obtain but unless the particular specimen is of the right composition it will be found that the enamel dissolves silver with the result of giving a yellow instead of the colorless result sought.

As a result of analyzing suitable enamels, followed by an almost incredible number of experiments, I found it necessary to use arsenate of lead in the composition. This is the material used for spraying elm trees for the destruction of the beetle.

Excellent results are obtained by melting in a sand crucible the following mixture:

Finely Divided Silica (free from iron	30 parts
Red Lead	28 parts
Powdered Borax	30 parts
Powdered Saltpeter	3 parts
Arsenate of Lead (dry)	3 parts

Mix the ingredients thoroughly in a porcelain mortar and in melting keep the crucible covered and in an oxidizing condition (i. e. free from smoke and cinder).

With this as a base, the colors are to be made by adding to the original mixture suitable oxides to impart the color.

The resulting colors are free from yellow degredation which is found when unsuitable enamels are used on silver.

The chemical principle at the bottom of the use of lead arsenate is as follows: The lead and arsenic compounds exist in two states of oxidation, both colorless. The arsenate exists in the enamel in the highest state of oxidation. When such an enamel is heated on a silver surface, the excess of oxygen in the arsenate tends to form oxide of silver which does not dissolve in the enamel.

This enamel base is suitable for all colors except gold and copper pinks.

Phosphor-tin is quite apt to contain lead as an adulterant. The addition of a small quantity will greatly cheapen it and enable the manufacturer to make a large profit.

Scrap Copper, Brass and Composition Specifications.

The following specifications for old copper and brass have been furnished by one of the most prominent dealers in old metals in New York City:

Copper, Heavy, Cut and Crucible.—This shall consist of any copper not less than 1/16 in. thick, free from foreign substances, except that a small percentage may have solder marks on it, but no lumps of solder, and shall be cut up in pieces about 5 in. wide and 10 in. long. This shall be the maximum size. If cut up in small pieces it will be considered crucible copper. This description applies also to "uncrucible" heavy copper, except as to its being cut up in pieces.

Copper Wire.—It shall be free from all insulation and from hair wire; also from other metals, such as brass and solder, and from other foreign substances.

Light Copper and Bottoms.—These shall consist of the bottoms of tea kettles, wash boilers, and hot water boilers.

Heavy Brass.—This material shall consist of any solid pieces of brass small enough to go into a 6-in. opening. The approximate mixture of this is 65 per cent copper and 35 per cent spelter. This, of course, varies; sometimes copper is a little lower, but it is usually higher. It shall be free from iron and other foreign substances.

Light Brass.—It shall consist of material like lamp tops, and may have a small percentage of iron that is not easily removed. It may also have some traces of solder on it, but not very much.

Heavy Machine Composition.—This is sometimes called red brass and shall consist of metal that contains a greater or less percentage of tin, and is usually about 80 per cent. copper with a small percentage, sometimes, of lead and zinc. The best grade of composition is composed of copper, tin and a small percentage of spelter, but it is still composition if it has a larger percentage of spelter and a small percentage of lead. But it must always contain not less than 5 or 6 per cent. of tin; the smaller the percentage of tin, the less valuable it is. It is marketable in any form, but has greater value if in pieces that are small enough to go into a 6-in. opening. Steam valves and similar articles, also engine bearings, come under the head of composition.—*The Iron Age.*

The Coating on Nickel Anodes.

Platers frequently complain that a thick coating of foreign material forms on their nickel anodes and that they do not think they are what they should be. They imagine they are contaminated with a large amount of foreign matter. In such instances it will usually be found that the deposit of nickel is good, and the only difficulty is the *appearance* of the anodes.

In connection with this nickel anode coating let it be understood that commercial nickel anodes are never pure, and if they were they would not be satisfactory. They contain iron, carbon and tin, all added intentionally, and not as an adulteration. These substances are added to the nickel to render it "soft," i. e. to make it dissolve in the solution. Were they not added the anode would be "hard" so that it would remain in the plating solution unattacked and smooth; and while it might have a good appearance as far as being clean and bright is concerned, it would be of no value for the reason that it would never supply nickel for replenishing the solution. The "soft" anode, then is the better.

When such a "soft" anode dissolves in the nickel plating solution as the plating goes on, the iron partially dissolves, but the carbon and tin are left on the surface. This is what is known as the anode "slime" or "coating." If the nickel anodes are frequently cleaned, as they should be, this slime is removed with the cleaning; but if it is not removed and is allowed to accumulate, it reaches considerable thickness as the anode becomes older so that the plater imagines that he is becoming cheated.

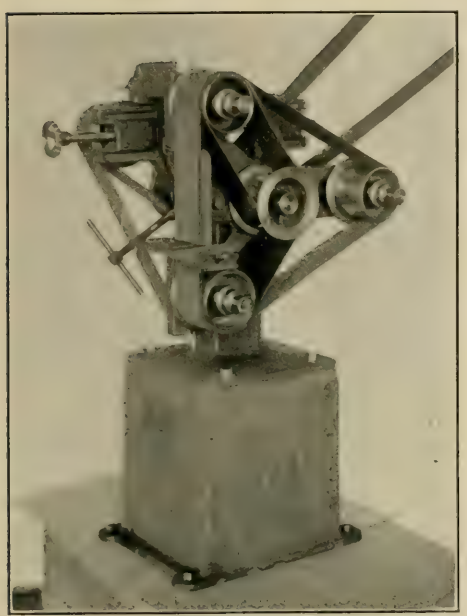
The best method of ascertaining that this anode slime is of little importance is to dry it and note how light it is. It weighs very little. In addition to its small amount, as far as weight is concerned, it may also be said that it costs nothing for the reason that anode makers charge for nothing but the nickel in their anodes and the rest is free.

Platers should not look upon the anode coating seriously, therefore, as, while it may appear quite voluminous when wet, it weighs but little when dry and has cost nothing.

Soft solder may be easily dissolved from silver goods without attacking the silver by boiling in a solution of perchloride of iron.

The New "Peerless" Surfacing Machine for Brass, Bronze, Steel and Other Metals.

Since the advent of endless belts, made from merchantable emery or garnet cloth, such as now used in the arts, and special machinery to carry this seemingly light material and introduced and patented by E. J. Bein in 1896, the extent to which the art has developed can hardly be conceived.



The New "Peerless" Surfacing Machine.

Whenever applicable, it is a substitute for hand filing and thus dispenses with expensive labor, producing far better finishes, square and perfect edges, grinding with the square, and giving the work a machine finish impossible to do by rotary motion which necessarily produces circular lines that are quite objectionable on high class work.

New devices are constantly developing, and among them is the new "Peerless" surfacing machine herewith illustrated and just patented by Mr. Bein. The machine has many valuable features, can be adjusted at any angle or used in a vertical or horizontal position. Three belts are employed, each having an independent adjustment. The machine is driven from a central shaft, forming the axis around which the whole machine revolves. Power is transmitted to one loose pulley driven from the center driving pulley, which, in turn, transmits power to the others. The intermediate belt is used as a cushion under the abrasive or grinding belt, and where work need not be absolutely straight, it will prolong the life of the belt very materially.

This machine is a small one and is designed to meet the wants of brass and other metal finishers. Having two belts, coarse and fine, it enables the operator to finish the work up in one operation. For irregular shapes, the flexible side of the belt can be employed which will conform to the contour of the material to be finished.

The machine is well built and the pulleys and bearings are fitted with brass bushings and are dust-proof. The whole is very compact, takes very little floor space and can, when desired, be used as a bench machine by removing the base. The machine is sold without the base when so desired.

There is an endless variety of work upon which the machine can be used and unskilled labor can do the finest quality polishing only produced by the most skilled when the regular method of polishing is carried on.

Dragon's Blood in Lacquers and Varnishes.

In the Daily Consular Report, Consul E. S. Cunningham, of Bombay, India, gives the following information in regard to this useful material:

Dragon's blood, which is used for coloring varnishes, as a medicine, and in photo-engraving processes, is procurable from grocers and druggists in every bazaar in India. Both the false and true dragon's blood may be purchased in the Bombay market.

Sir George Watt says that certain canes and rattans when freshly cut contain a large quantity of a liquid which, when evaporated, produces a red resin. One of the best-known qualities of the resin is sometimes called East Indian dragon's blood. This is mostly pre pared from the fruits of several species of Calamus found in the Straits Settlement. The gum exudes naturally from between the scales of the fruit, and, being friable, is collected by shaking the fruit into baskets and then sifting the resin from the stems and particles of woody fiber, after which it is melted

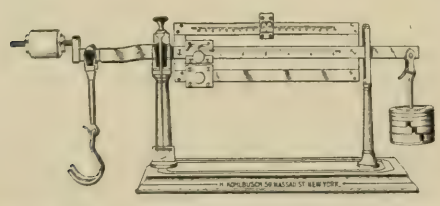
either by the heat of the sun or boiling water. The only Indian species hitherto reported as affording this resin is Dœmonorops kurzianus. The false dragon's blood met with in Indian commerce is imported into Bombay from Sumatra, Penang, etc. The true dragon's blood, however, is procured from Socotra and is obtained by tapping the stems of several species of Dracœena, not Calamus.

Other technical publications state that Canary Islands dragon's blood is the variety obtained from the celebrated dragon tree of Teneriffe and adjacent islands, Dracœna draco. Very little of this now finds its way into European commerce, and the same can be said of Mexican dragon's blood, which latter is obtained from Croton draco.

American official statistics show that the imports of dragon's blood entered for consumption in the fiscal year ending June 30, 1909, aggregated 43,396 pounds, with an appraised value of 29.6 cents per pound and in the fiscal year 1910 they amounted to 26,555 pounds, value 34 cents per pound. Dragon's blood comes in free of duty.

Scale for Use in Silver Plating.

All the large manufacturers of silver-plated flat-ware now use scales for determining the weight of silver that is being deposited while the electrodeposition is going on. In this manner it is possible to deposit uniform coatings on the goods and insure against over plating.



Scale for Use in Determining the Amount of Silver Being Deposited on Plated Goods.

Such scales are herewith illustrated. They can be set to indicate the amount of silver which it is desired to deposit so that when it has been obtained, an electric bell will ring. The rack containing the goods to be plated is hung at one end of the beam and in the solution. The weight is set at the desired amount of silver. When the amount of silver has been deposited, its weight pulls the beam down, and at the same time the bell rings thus indicating to the plater that the operation has been completed.

The top bar is divided into ¼ pennyweights (but ⅛ can be read) to 10 pennyweights on each side of the center which either can be used for weighing purposes or to try how much more or less it needs for the required result. The second bar is divided up to 6 oz. Troy in 2 pennyweights and the amount of silver deposited is weighed on it. This can be set at any given weight. For example, if 4 dozen spoons are suspended from the scale hook in the solution and wish to deposit 3 oz. of silver on them, the weight is set at 3 oz. and screwed tight. When the beam is balanced by the silver deposited, as indicated by the pointer on the dial, the required amount has been deposited.

The lower beam and end weights are used only to balance any material put on. Ordinarialy it is made to carry up to 5½ lbs. but this amount can be increased when desired.

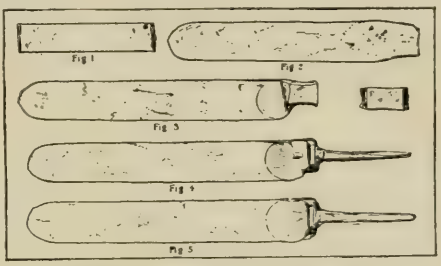
Handforging of Cutlery in England.

Many ancient and skilful crafts have disappeared or are disappearing before the advance of mechanical processes, but among those which survive, the forging of knife blades by hand is a conspicuous and interesting example. Without disparagement of machine-hammered knives, it may be said with certainty that in choosing the hand-forged goods the buyer can absolutely rely upon getting the maximum of quality, because only the best steel is supplied to the forger, and his manipulation of it tends to produce the finest cutting edge possible, and one which will last. The faint thumb-mark (as it is termed) on one side of the blade just above the bolster indicates that the knife is hand-made, so that the buyer need never be deceived as to what is being supplied to him.

Watching the blade forger and striker working at their anvil and hearth, suggests to the uninitiated observer a simple and comparatively easy task, but it needs a close acquaintance with the process fully to appreciate the great amount of skill and care, to say nothing of inherited capacity which it represents. Like poets, forgers are more often born than made, and it is quite possible for a young man to discover after seven years' apprenticeship to

the trade that he has no chance of becoming a competent workman. The difficulty which the thorough learning of the trade presents and the uncertainty of attaining proficiency in it are among the reasons why so few apprentices are to be found. The forger of to-day earns fairly good wages, his trade, although hard and exhausting, is healthy, and he occupies a position of independence which is rare among workmen. He knows no master in the ordinary sense, and works pretty much when and where he pleases, and some forgers ply their craft at a hearth in their own back-yard, while the remuneration is invariably on a piece rate basis.

The forging of table knives is a "two-handed" trade. That is to say, it is performed by two men, a forger and a striker, the latter's hammer being heavier than his mate's. The striker also performs the delicate process of hardening and tempering. The raw material of the forger consists of steel bars (Fig 1), rolled into flat, thin sections of the size, shape and thickness required for the various patterns of knives made. He first heats one of these bars and hammers one end into a rough blade known as a "mood" (Fig. 2). Guided only by his eye, and assisted, of course, by instinct and experience, he can gauge exactly the the amount of steel which the blade will require, so that it is never necessary for him to cut away subsequently any of the metal through taking too much, or to reduce its thickness because he has underestimated the quantity. The "mood," after being cut from the rod of steel, is next welded to a rod of charcoal iron, from which the bolster and tang are to be made. High-class steel being expensive, it is not used for those parts of a knife which are not required to cut, and it is more economical and more serviceable to form the tang and bolster out of iron. Having cut off as much iron as is needed, there is left what is known as a "shot" blade (Fig. 3), the bolster being then produced by hammering the lump of iron in a mould of the shape required, and leaving a portion to be drawn, by several skilful blows, into a tang (Fig. 4). Here, again, the forger can accurately calculate the amount of iron required to fill the top and bottom tool to make a shoulder and tang of the right size, for he rarely gets too much or too little. It is also deserving of note that the production of a perfect and neat weld is essentially a craftsman's operation. Next follows the smithing. By means of his hammer the forger accurately shapes the blade in the form in which it is to go to the grinder, and he must leave a thin cutting edge and a graded taper from edge to back and from point to bolster. At this stage the name or mark of the maker is struck on the blade (Fig. 5).



Method of Forging the Cutlery

It is impossible to over-estimate the importance of the hardening and tempering process which follows, because if it be unskilfully done the best steel is spoiled and the knife cannot be satisfactory. The blade is kept in the fire until it acquires a cherry-red colour, and is then quickly withdrawn and plunged into cold water. This action makes the steel almost as hard and brittle as glass, and in that condition it would break into fragments if dropped on a stone floor.

It is now the task of the striker to "let down" the temper; that is, to reduce the hardness to a point which gives elasticity and makes it a usable tool. A great deal of judgment, experience, and natural aptitude are necessary to do this successfully. The degrees of hardness are ascertained by the colour. Razor blades are left extremely hard, while carver blades have to be softer than table-knife blades. The operator must also take into consideration the ingredients and the nature and quality of the steel and the special purpose for which it is intended. When at the hardest point, the steel presents a greyish-white appearance, but while being "let down" in the fire the shades of colour are successively straw, mottled brown, purple, dark blue, and finally (for table knives) light blue. In the course of the forging processes a blade is heated no fewer than five times in addition to being warmed for tempering.

From the above description, it will be gathered that hand-forged cutlery is subjected to a great amount of hammering and it is

to this that its superiority is mainly due. According to the authorities on the subject, every additional blow improves the quality of steel by condensing it and closing its fibres. The human factor in the process is especially valuable, because the man can feel the various inequalities of hardness and softness always present in steel, of which a machine can take no account, and by varying his treatment, produce uniformity, with the result that the blade leaves his hands free from those flaws and blemishes which tend to impair its efficiency and shorten its life.—*The Ironmonger.*

The Best "All-Around" Aluminum Mixture.

Time is the greatest of teachers and it has succeeded in teaching us much in the line of aluminum metallurgy. One of the principal lessons is that the best "all-around" aluminum mixture for making aluminum sand castings is one of aluminum and copper. While, in the early days of aluminum sand castings, the aluminum and zinc or aluminum, zinc and copper mixtures were extensively employed, they were found wanting, and time has demonstrated that the results have been fully warranted. The aluminum and copper mixtures are now advocated by all the authorities on the subject for the reason that they are what is known as "safe" mixtures, while those containing zinc are treacherous. Many a founder has found this out to his sorrow.

Experience has shown that for "all-around" work in the making of sand castings of aluminum the following is the most satisfactory:

Aluminum	92% or 92 lbs.
Copper	8% or 8 lbs.

This mixture casts exceptionally well, does not crack in the mold or crystallize in service and is fully strong enough for the majority of work for which aluminum castings are used. It should be borne in mind that aluminum is a weak metal and in addition, sand castings can never be employed in engineering work with the same degree of certainty as steel forgings. The difference in tensile strength between the aforesaid aluminum and copper alloy and those containing zinc is but little so that when the safety of the aluminum and copper mixtures is taken into consideration, there is no reason why it should not be almost exclusively used as it now is in the making of sand castings.

The fact that the aluminum and zinc mixtures are strong has always been attractive, but the cheapness is the principal reason why many brass founders have used it. While cheap and strong, however, the tendency to crack in mold is such that unless simple shapes are to be cast, much reliability cannot be placed upon the castings. One of the disagreeable features of the aluminum and zinc mixtures is that, while the casting may look well when it has been cast, and to all appearances be sound and homogeneous, a slight strain put upon it such as that which occurs in the machining or while in use, may develop or open unseen cracks which have never before been noticed. It is to this fact and this alone that the danger in using the aluminum and zinc mixtures is found. Were it possible to cast them without the uncertainty that now exists, the aluminum and zinc mixtures would be very extensively employed.

In the use of the aluminum and copper mixtures, the manner in which they are made has much to do with the success of the casting. To weigh out 8 lbs. of copper and 92 lbs. of aluminum and then melt them together is not the right method of making the mixture. If it is done, the heat necessary to melt the copper causes the aluminum to become overheated, and the result is that the metal becomes "burnt". The castings then produced are weak and apt to contain pinholes.

The right method of procedure in making the aluminum and copper alloy is to first make up a rich alloy of aluminum and copper and use this for the introduction of the copper. As this rich alloy melts at a comparatively low temperature, the aluminum to which it is added is not overheated and a good metal is the result

To make the rich alloy take the following:

Rich Alloy.

Aluminum	1 lb.
Copper	1 lb.

. Melt the copper first and then add the aluminum to it, and stir thoroughly. Then pour it out into ingot molds. This will give a white, brittle alloy that is readily broken up into small pieces so that any desired weight may be obtained.

To make the 8% mixture, take the following:

Aluminum	84 lbs.
Rich Alloy	16 lbs.

The aluminum and rich alloy are placed in the crucible together and melted. Care should be

and non-porous substance and then removed from such models, so that the body or main portion of the vessel is metal without any taken to avoid heating beyond the point where the rich alloy melts. This point is easily ascertained by a stirring rod. When this has melted, give the whole a thorough stirring and it is ready for use.

When the aluminum and copper alloy is made in this manner there is no likelihood of "burning" the metal and, therefore, the castings made from it are stronger and sounder than were the copper alloyed directly with the aluminum without first making the rich alloy. Pin-holes are less apt to be found in the castings as these annoying things always come from overheating the metal during the melting.

Properties of Metallic Titanium

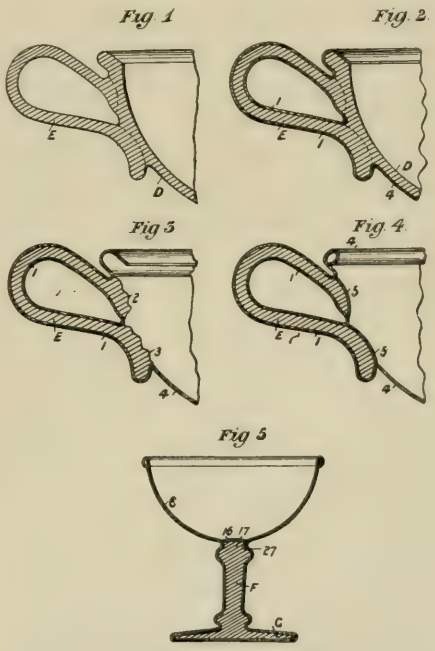
In *Rensselaer Polytechnic Institute Engineering and Science Series,* Feb. 1, 1911, M. A. Hunter and E. C. Jones give the results of their experiments on the preparation of pure titanium. They say that the reduction of sodium titanifluoride by means of potassium yields metallic titanium containing only about 73 per cent of this metal. The reduction of titanium dioxide by carbon gives a metal which contains not less than 4 per cent of carbon. By the reduction of titanium tetrachloride by means of metallic sodium, they have succeeded in obtaining metallic titanium which showed 99.9 per cent purity. A special bomb apparatus was employed for the reduction. The bomb was of steel and an analysis of the metallic titanium produced showed it to contain no traces of iron or sodium.

In appearance the metallic titanium produced resembled polished steel. It is hard and brittle when cold, but when red hot it can easily be forged. The melting point of the pure metal was found to be between 1800 and 1850 degrees C. and the specific gravity is 4.50.

Cadmium is readily plated on any metal from a cyanide solution in the same manner as copper, but as yet no use has been found for such a deposit.

Producing Hollow-ware by Electrodeposition.

In THE BRASS WORLD, April, 1911, page 139, was described a method of Frank Iorns Gibbs of Birmingham, England for producing hollow-ware by electrodeposition. The process consists in depositing metal (copper or silver) on a smooth glass, porcelain or china article and then removing it. The surface of the deposited metal is smooth like the form upon which it is plated.



The Manner of Producing the Hollow-ware.

This inventor has now improved his process (U. S. Patent 998,085, July 18, 1911) so that more difficult pieces may be produced. He describes his process as follows:

"This invention consists of the described improvement in producing metal vessels by electro-deposition, such vessels for instance as tea pots, jugs, cups, vases, drinking cups, and the like, which have projecting spouts or handles or legs or stems or bases or other like projecting parts the said metallic vessels having been formed by electro-deposition on the prepared surfaces of models of glass or potteryware or other suitable non-metallic

glass or pottery-ware or other non-metallic lining. In order to facilitate the production of strong spouts, handles, stems or bases or the like integral with said vessels I proceed as follows:

The glass or potteryware or other non-metallic and non-porous model is formed with the required handle or spout or legs or stem in a piece therewith and these are coated with the metallic paint or other conducting material so that the metal will be electro-deposited on these handles or spout or legs or other projecting parts as well as on the body of the model, but when the body part of the model has been broken away and removed the potteryware or glass or other handles or spout or other projecting parts of the model will remain permanently embedded in the electro-deposited vessel and at their ends where they have been broken away from the model inside the vase or other article the glass or potteryware or other part can be ground down and then coated with the metallic or other conducting material and the required metal electro-deposited over these ends of the handles or projections so that they will not show on the inside of the vessel. Or if desired, metal blanks may be fixed to cover these ends of the handle or parts. This will be clear by an examination of the accompanying drawings of which Figure 1 is a sectional elevation of the handle and part of a potteryware model for forming a tea cup by electro-deposition; Fig. 2 shows the same parts as Fig. 1 with the metal electro-deposited thereon; Fig. 3 shows the deposit and the handle part of the model embedded therein after the part of the model which formed the body part of the tea cup has been broken away and removed from the deposit; Fig. 4 shows the finished tea cup with the handle part of the model embedded in the deposit and entirely inclosed as hereinafter described and Fig. 5 is a sectional elevation of a metal drinking vessel or cup with the stem part of the model embedded therein."

The presence of carbon in nickel anodes is beneficial as it renders them "soft" (i. e. easily dissolved).

To produce a white dip silver deposit on brass, practically no free cyanide should be in the dip.

Output of Platinum, Iridium, Osmium, Palladium, Rhodium.

The following information is taken from the advance chapters of U. S. Geological Survey publications:

Platinum. The actual production of crude platinum in the Urals in 1909 is now estimated at 190,087 oz. Troy. In the same year, New South Wales produced 440 oz., Sumatra and Borneo are believed to have yielded about 500 oz., 2393 oz. were exported to the United States from Columbia and a small amount was produced in British Columbia. The output of crude platinum in the United States was 672 oz. not including the considerable quantity of secondary metal annually recovered from scrap materials of all kinds. 118,853 oz. of crude platinum, including unmanufactured products, sheet, wire etc., and valued at $2,557,596 were imported into the United States in 1909, chiefly from Russia.

Iridium. 341 lbs. of iridium, valued at $135,878 were imported into the United States in 1909. The metal is obtained chiefly from crude platinum in which it generally exists alloyed with osmium as iridosmine. Most of the iridium produced is probably employed for hardening platinum, the iridium content of which ranges from 5 to 20 per cent. Such alloys are hard and difficult to work when the iridium reaches from 10 to 20 per cent and they are not attacked by aqua-reagia when the contents of iridium reaches 30 per cent. Iridium is used for other scientific or technical purposes, but owing to its brittleness, the pure metal is very difficult to work. The metal has been increasing rapidly in value, the average price in 1909 was $35 per oz., whereas in October 1910, the metal was quoted at $60 per oz.

Osmium. Four pounds of osmium, valued at $1569, were imported into the United States in 1909. Except in the manufacture of certain kinds of incandescent lamps, the metal is but little employed.

Palladium. The imports of palladium into the United States in 1909 amounted to 33 lbs., valued at $13,416. The metal occurs in small quantity in crude platinum and in certain copper deposits. The demand is considerably greater than the supply, the most extensive use being in the manufacture of certain dental

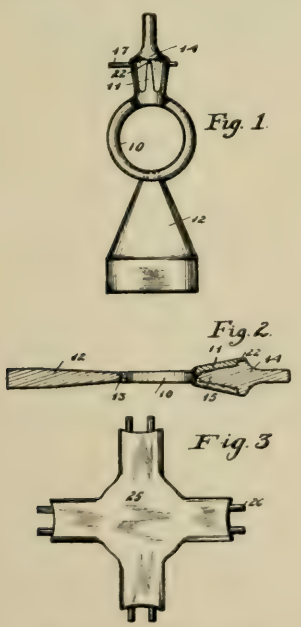
alloys. The metal is also used in watch making, for the circles of astronomical instruments and in the soldering of platinum.

Rhodium. The price of pure rhodium is stated to be about $155 per ounce. The metal occurs in crude platinum in amounts up to 4 per cent. It is used chiefly in the thermo-electric couples of pyrometers.

A Pattern for Casting Finger-Rings.

An improved method of casting finger rings of gold or other metals has been patented by Fred H. Curl of Des Moines, Iowa. The feature of the patent lies in the pattern employed and which is herewith shown.

Referring to the accompanying drawings, 10 is to indicate the body portion of the ring member of the improved pattern. At one point on the circumference of the body portion is a series of prongs 11 of the kind and

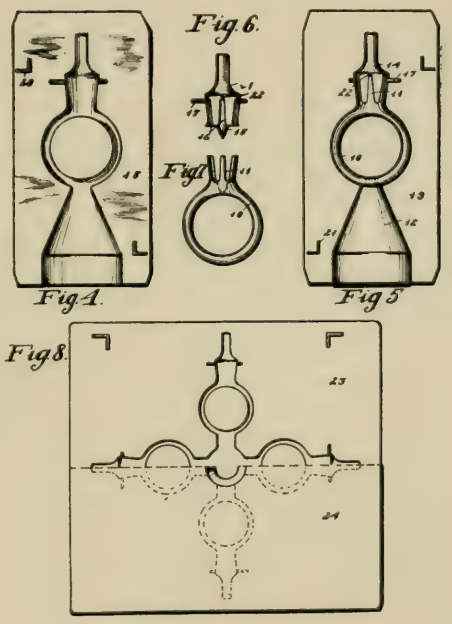


The Pattern for the Rings.

shape now in common use for the purpose of holding precious stones. At the side of the body portion 10 opposite from the prongs 11, preferably provide two small openings such as indicated by dotted lines in Fig. 1, for the purpose of receiving a gate pattern.

In connection with the ring pattern member a core member is employed which comprises a body portion 14 having a central cone-shaped portion 15 designed to enter the interior of the space between the prongs on the ring pattern member, and also provided with a series of recesses 16 designed to receive said prong members on the ring portion. Extended through the body portion 14 is a guide pin 17 having one short and one long end projecting beyond the body portion.

The mold comprises a number of upper and lower members, the upper member being indicated by the numeral 18, as shown in Fig. 4, and the lower by the numeral 19, as shown in Fig. 5. These mold members may consist



The Mold for the Rings.

of two pieces of cuttlefish bone or they may be made of ordinary mold frames employed in connection with molders' sand or other suitable material. In order to provide for holding the two mold members in coinciding positions, provide a number of L shaped metal guides 20 partially embedded in one of the mold members 18 and designed to enter corresponding depressions made in the other mold member as shown at 21 in Fig. 5.

In practical operation with this form of my invention connect the ring pattern, the core pattern and the gate pattern, as shown in Fig. 5, and then place them in position upon the mold member 19 and then place the mold member 18 on top of it and force the two

mold members firmly together. This causes the material of the cuttlefish bone to de depressed at the points where the pattern members engage it so that the adjacent surfaces of the mold members may come in contact with each other. Then remove the complete pattern and finally replace the core pattern thus leaving the mold cavity in the material consisting of the gate and of the ring member. The notches 16 of the core member are so arranged that the metal will flow into them and produce perfectly formed prongs for the ring being molded. The melted precious metal is then poured into the mold in the ordinary way and small grooves 22 are provided at the ends of the notches 16 through which the air bubbles may escape at the ends of the prongs.

A New Wax Composition for Electrotyping.

A new wax composition for electrotyping has recently been patented by George E. Dunton of New York City (U. S. Patent 996,751, July 4, 1911). It is to be used in place of the ordinary beeswax universally employed in electrotyping. The object of the new composition is to overcome the exuding of oil or grease from beeswax when it is pressed on to the form. This oil is quite objectionable when the wax is used in taking the impression of a fine half-tone plate as it fills up the fine dots and thus prevents a perfect impression. The new composition is composed of the following:—

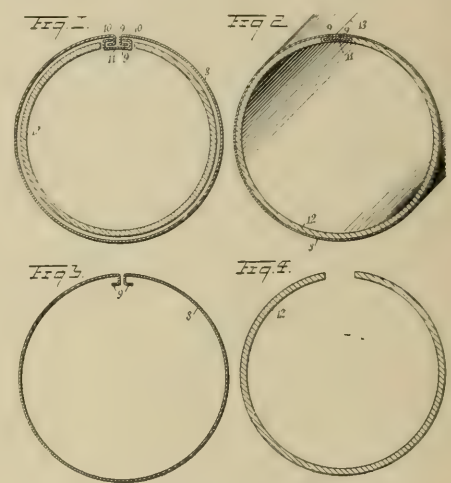
Beeswax (or Ozokerite)	50 lbs.
Gum Chicle	2 lbs.
Venetian Turpentine	4 oz.
Borax	¼ oz.
Caustic Soda	2 oz.

The mass is melted together. The gum chicle is used to toughen the wax. This gum is the material of which chewing-gum is made and is quite plastic and tough.

The presence of iron in nickel renders it whiter. All nickel anodes contain iron, and nickel deposits also contain it. The deposit which contains iron is thus whiter than one free from it, but is more readily tarnished.

An Improved Method of Making Steel Lined Brass Bedstead Tubing.

An improved method of making brass bedstead tubing has been patented by Patrick H. Friel of Kenosha, Wis. The method of making the tubing is as follows: The steel lining is shown in Fig. 4 and is formed for sheet steel. The sheet brass covering is indicated in Fig. 3 and the edges are bent in the form shown. When the brass covering is



Method of Making the Tubing.

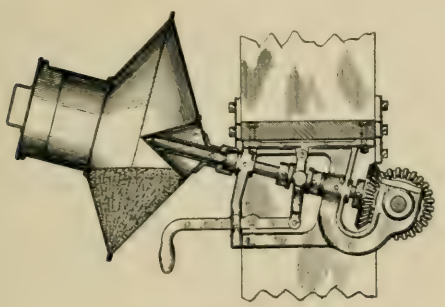
placed over the steel lining, it has the appearance shown in Fig. 1, but a grooved sheet metal locking device 11 is placed over the edges of the brass sheet, in order to hold it securely. The whole compound tube is then drawn through a suitable die so as to compress the joint and produce a commercial tube suitable for the manufacture of brass bedsteads or other articles.

Whether the spelter-chills are instrumental in shortening the life of those who habitually have them is an open question. English physicians, who have made a study of the subject maintain that it is, but it is quite certain that the habits of those who work in brass foundries and casting shops have a strong bearing on the subject, and are partially responsible in many instances for the early death of the brass worker, although the chills are believed to have been directly responsible. In the United States it is believed that the spelter chills are not a particularly dangerous ailment.

A New Form of Tumbling Barrel for Thin Sheet Metal Goods.

An improved form of tumbling barrel has recently been patented by William E. Nickerson of Cambridge, Mass. It is intended for the tumbling, and accompanying polishing, of thin sheet metal articles and more particularly for tumbling Gillette safety-razor blades which, as generally known, are extremely thin.

The polishing rumble is shown in the form of an annular trough. A working space is formed between the walls. The spaces forming faces of the walls are shown disposed at



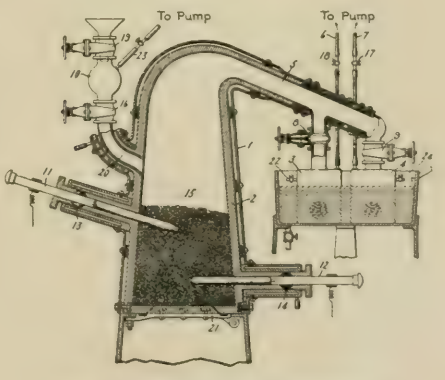
The Tumbling Barrel.

an acute angle one relative to the other. This space for convenience may be said to be V-shaped in cross-section. Each of the walls is shown substantially conical and, of course, the cross-sectional radius of either wall, is shown disposed on a line substantially parallel with the diametrically opposite cross-sectional radius of the other wall. The V-shaped trough has its apex at the periphery, and this apex is revoluble on a plane at an acute angle to the vertical.

Owing to the relative positions of the walls and the angularity of the axis to the horizontal, the working space forming face of the wall is disposed at a more acute angle to the vertical at the lower portion than at the upper portion and the space forming face of the wall is disposed at a less acute angle to the vertical at the lower portion than at the upper portion. As the rumble revolves the faces of the walls change relative positions in respect to the vertical in passing from the low to the high portion of the orbit of revolution. The mass of polishing materials and articles under treatment located in the rumble wall wedge and jam together to a certain extent in the lower portion. Upon rotation of the rumble, this mass will be revolved through an orbital path until it has assumed a position above its first position. Gravity will cause the mass to be released and to rumble into position, first rapidly and then constrictedly until the whole mass is again wedged in the trough when it will be carried up again as before. The relative change of position of the walls in respect of the vertical during this revolution of the mass assists in the release of the side-gripping action of the walls upon the mass and the rapid release of the entire mass, so that the rumbling action and effect will be most efficient.

Apparatus for Distilling Metals in a Vacuum.

An apparatus for the distillation of metals in a vacuum has recently been patented by Colin G. Fink of the General Electric Co. of Schenectady, N. Y. It is claimed by the inventor that arsenic, antimony and other volatile metals may readily be separated from other metals without any oxidation whatever.



The Vacuum Distilling Apparatus.

The vacuum is maintained by means of a suitable air pump (in the majority instances only a partial vacuum is required), and the heating is carried out by means of two electrodes through which an electric current is passed. The metals distil into a receiver in the same manner that a volatile liquid would do.

Questions and Answers.

QUESTION No. 1013. How is the hard enamel made and put on watch fobs, name plates, etc.

Answer. The hard enamel is applied in the form of a paste to the article to be annealed, and then "fired" in a muffle furnace, i. e., the enamel is melted on. The mixture for the enamel will depend upon the color, kind of work, etc., and for this refer you to any of the treatises on enameling as there are many different kinds of formulas for the different kinds of effects desired.

QUESTION No. 1015. How can small particles of lead be removed from the surface of sterling silver. These come from the lead forces used in the drop presses.

Answer. You can probably remove the lead from the silver by the use of a hot muriatic acid solution. Take equal parts of water and strong muriatic acid and heat to about 150 degrees. Immerse the silver in this solution until the lead is taken off. You will have to polish or buff the surface again, however, as the muriatic acid will tarnish it, although it will not attack it. Immersion in a cyanide solution will remove the stain, but will leave the surface dead. A strong solution of potassium cyanide (1 lb. to 1 gallon of water) is used.

QUESTION No. 1016. What is the composition of "Parson's White Brass" used as an anti-friction metal?

Answer. The analysis of an ingot of this metal showed the following:

Tin	65.12%
Zinc	31.71%
Copper	2.87%
Iron	0.13%
Lead	0.17%

The iron and lead are present as impurities. If it is desired to make up the alloy, then take the following:

Tin	65 lbs.
Zinc	32 lbs.
Copper	3 lbs.

A fairly good grade of zinc is necessary, although the best grade of refined metal is not required.

QUESTION No. 1017. We desire to use aluminum in the manufacture of a coffee pot and wish to ask if it will be attacked by the coffee so that the user would suffer from the effects?

Answer. The alumium will be slowly attacked by any liquid used in the food line, but coffee will attack it only very slowly. As aluminum salts or compounds, unless taken into the stomach in considerable quantity are not injurious, it can safely be said that the aluminum can be used in your coffee pot without incurring any danger. There will be an extremely small quantity of aluminum dissolved. The aluminum will be slightly corroded, however, so that it will require constant cleaning and scouring.

QUESTION No. 1018. What disposition can be made of pin dust? This dust is free from oil and foreign matter of any kind and we believe there is a market for it, but we do not know where it can be sold except in the scrap metal trade.

Answer. We do not know of any market for pin-dust except in the scrap metal trades. It is customary to sell it to copper smelters. Those who make brass ingot metal have tried to use it, but it wastes so much in melting that it has not been found profitable.

QUESTION No. 1019. Two samples of prop nuts for a carriage are submitted to you for inspection. These nuts have been nickel plated (on the brass base) and then buffed. They were both plated the same and for the same length of time, but you will notice that the surface of one is cloudy, while the other perfectly bright. What we wish to find out is why the one should be cloudy and the other perfect?

Answer. Your difficulty has been caused by the buffing and not the plating. In buffing it is possible to "burn" metal by too much pressure on the wheel. This produces a cloudy surface. Too high a speed on the buff wheel, and too great a pressure at the same time will produce the cloudy effect. In buffing soft metals, this cloudy effect is formed very readily if great care is not used.

QUESTION No. 1020. About how much lead should be added to a drawn brass rod to render it free cutting?

Answer. It has been found that about 2.25% of lead in the so-called leaded brass screw rod is about the maximum quantity that can be added and still be able to draw or roll it well. If a greater quantity is used, the brass becomes more refractory in the rolling or drawing, and if less, it will not cut as freely.

QUESTION No. 1021. I want to plate a wood picture frame with copper, but have been unable to do so. I put on a coat of lacquer and then varnished it, after which I applied plumbago but it would not stick. How shall I go about it?

Answer. Give the wood frame a coat of thin shellac and allow to dry thoroughly. Then apply a coat of ordinary varnish such as used for varnishing furniture or interior wood work. Allow to partially dry until it is quite sticky or tacky, and then apply to the surface, with a soft camel's hair brush, the finest copper powder. This copper powder is known in the trade as "copper bronze" and is simply a very fine copper powder. Brush well into the varnish and then allow the whole to dry for 12 hours or more until the surface is free from stickiness and is hard. Then brush off the excess of the copper powder and the frame will be ready for plating. You will have no difficulty in plating over this.

QUESTION No. 1022. Is there any way of rendering composition or bronze red except by the use of more copper? We are obliged to put in a price on castings, but find that those previously supplied by a competitor are

redder than ours. At the price, we cannot afford to use any more copper.

Answer. There is no method of rendering composition or bronze redder except to use more copper. The reason why your competitor is able to use a metal containing more copper may be that he purchases scrap or is buying his raw materials to a better advantage than you.

QUESTION No. 1023. We send you a steel butt that was bronze plated. You will notice that there is a dark red scum and a number of streaks on it. What causes these?

Answer. The cause of the streaks and dirt on the butt is that the polishing dirt has not been washed out of the joint previous to plating. During the bronze plating it works out and produces the streaks. If you wash out this dirt before plating you will have no further difficulty. It is a common difficulty and one which is readily remedied.

QUESTION No. 1024. Can you supply us with a formula for a white metal that will be sulphur resisting? We have a call for bath fittings to be made of all white metal where sulphur water is used.

Answer. Use the following:

Copper	50 lbs.
Zinc	35 lbs.
Nickel	15 lbs.
Aluminum	2 oz.

This metal is very white and will resist the action of the sulphur water well. It casts well in sand.

QUESTION No. 1025. Is it possible to put a dark coating on roofing tin? We are making some small articles in which ordinary roofing tin plate is used, and we wish to give them a dark color.

Answer. The best way is to either japan or lacquer them, but you can copper plate them and then oxidize the copper in a liver of sulphur solution. There is no method of directly oxidizing the tin that is satisfactory.

QUESTION No. 1026. Are copper rods rolled hot or cold and what method is used for producing the smooth finish on the surface. Hot rolled steel and iron are somewhat rough on the surface, while the copper rods that we obtain are smooth.

Answer. Copper is always rolled hot, but when a smooth surface is desired it is necessary to roll or draw it cold. Either cold rolling or cold drawing through a die is used for smoothing the surface. After the rod has been hot rolled, it is pickled to remove the scale and then cold rolled or drawn.

QUESTION No. 1027. The concern with which I am connected have started to make their own spring washers and they are to be brass plated. I have been unable to plate them so that they will not break when compressed. I first tried pickling them to remove the scale and then brass plated them, and afterwards tumbled them instead of pickling them before brass plating. They all break when used showing that the temper of the steel has been affected. What is the cause?

Answer. The cause of your difficulty is that during the brass plating, hydrogen gas is given off and is partly absorbed by the steel, rendering it brittle. As it is impossible to produce a brass deposit without having hydrogen gas evolved from the work being plated, we doubt whether you will be successful. Pickling acts in the same manner as hydrogen gas is evolved and is absorbed by the steel causing it to become brittle. As nickel deposits give off very little hydrogen gas while being deposited, it may be possible that you will be able to overcome the breaking by tumbling the washers to remove the scale, then nickel plating them and finally brass plating them with as weak a current as possible.

QUESTION No. 1028. Is it possible to cast yellow brass in plaster of Paris molds and produce a good casting? I have heard that it cannot be done.

Answer. The casting of yellow brass in a plaster of Paris mold is a very difficult operation as it gives off so much smoke (oxide of zinc fumes) while being poured that the casting is apt to be very dirty. The best way is to use a brass containing as little spelter as possible, together with a small quantity of tin to harden the mixture. The following mixture is good as it contains as small a quantity of spelter as it is possible to use and yet have the brass yellow:

Copper	78 lbs.
Zinc	20 lbs.
Tin	2 lbs.

When yellow brass is cast in ordinary plaster molds (even the preceding mixture) the production of a clean casting is difficult. In the Bohl process, the mold is coated over with an animal grease such as lard or tallow, and it is then possible to cast yellow brass without trouble.

QUESTION No. 1030. We wish a mixture for casting bronze letters to be used in a sidewalk. These letters must have a gold bronze color and not be so brittle that they will break. We want as cheap a mixture as possible.

Answer. Try the following mixture as you will find it cheap, of a fine gold color and strong. We believe it is the best mixture you can use for the purpose:

Copper	55 lbs.
Zinc	45 lbs.
Aluminum	¼ lb.

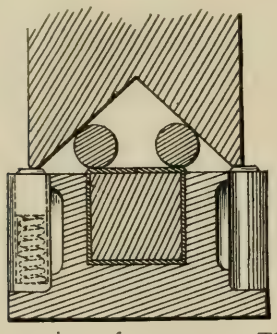
The metal gives better results when melted twice, and it must be poured at as low a temperature as possible.

QUESTION No. 1033. I have made a 15 gallon gold solution of chloride of gold and cyanide, but find it does not deposit yellow. It deposits a dark color. Why should it deposit so dark?

Answer. In order to obtain a yellow gold color you will have to deposit the gold over brass, unless a very heavy deposit is put on, as the color of the base metal shows through. A yellow gold deposit cannot be obtained on copper as this base metal will produce a red shade. The amount of free cyanide in the gold solution must also be quite low and the solution run with as weak a current as possible. Run the gold solution just barely warm.

Patent Abstracts.

997,709, July 11, 1911. APPARATUS FOR MAKING SQUARE TUBES. Peter H Seery of Newark, N. J. The method avoids the usual formation of a round tube and sub-

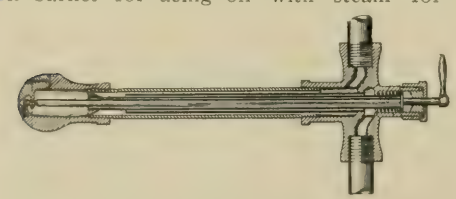


sequent formation of a square. The square tube is formed at once by a series of dies which fold the sides together so that the seam may be brazed or soldered. The process is applicable to any metal.

998,176, July 18, 1911. PROCESS OF MANUFACTURING LACQUERED OR PROTECTIVE-COATED CANS. John G. Hodgson of Maywood, Ill. Assignor to the American Can Co. of New York City. A method of lacquering sheet tin plate before being made into a can instead of applying the lacquer after the can has been made. The lacquer is used for protecting the tin in the preservation of foods.

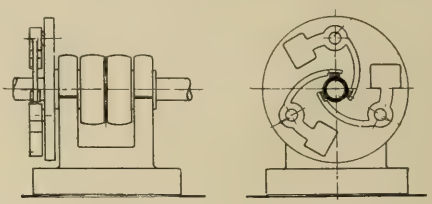
998,087, July 18, 1911. MACHINE FOR STRAIGHTENING AND CUTTING WIRE. Charles Greiner of New Haven, Conn. The features of this machine are, the obviating of the twisting of the wire in straightening, absence of waste from tail end pieces, and avoidance of danger to the workman from whirling of the tail end of the wire.

997,981, July 18, 1911. OIL-BURNER. Milton A. Fesler of San Francisco, Cal. An oil burner for using oil with steam for a



pressure medium. The novelty of the invention is in the means for varying the size of the opening for the oil and steam.

997,167, July 4, 1911. APPARATUS FOR POLISHING TUBES, RODS AND THE LIKE. Federico Werth of Milan, Italy. The tube or rod to be polished is fed into the apparatus and arms, fastened to a pin so that

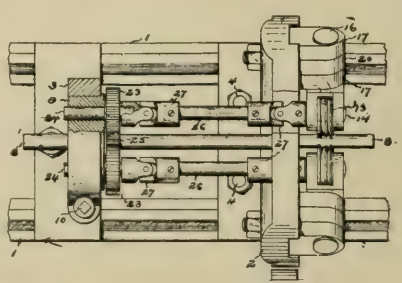


they can move or swing, and upon the end of which a brush or polishing appliance is placed, act upon the surface and polish it. The manner in which this works may be seen by inspecting the sketch.

996,661, July 4, 1911. EXPANSIBLE CORE-BARREL. Charles F. Murray of Evanston, Ill. A core barrel for casting large sections and is made to collapse when the casting has been made in order to facilitate removal and prevent the rupture of the metal around it when cooling.

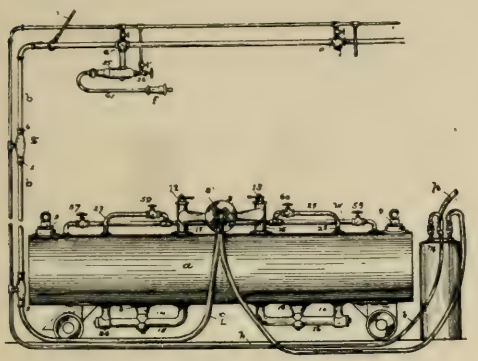
998,240, July 18, 1911. PREPARING MOLDS FOR ELECTROTYPES. George E. Dunton of New York City. A method of polishing and smoothing an electrotype wax mold at the same time it is being shaved. This is accomplished by a slight melting at the surface by means of gas burners as the shaving is taking place.

998,214, July 18, 1911. SPIRAL TUBE MAKING MACHINE. John W. Wallis of Waterbury, Conn. The machine is intended for the making of flexible metal hose or pipe.



The object of the invention is to make the pipe or tube from a strip of metal in a continuous manner and not have the intermittent character in the machine like that previously necessary.

998,111, July 18, 1911. SAND-BLAST APPARATUS. John D. Murray of San Francisco, Cal. A sand-blast of large capacity and working on a large scale. The apparatus is



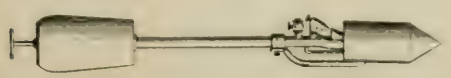
designed for use where the surface to be operated upon is situated at some distance from the sand-blast itself.

997,589, July 11, 1911. MIXTURE FOR COATING ELECTROTYPE MOLD FORMS. Arthur J. Williams of Washington, D. C. Instead of graphite for coating the wax mold, the use of a mixture of 2¼ lbs. of graphite in 1 gallon of alcohol is claimed. Saving of graphite is the principal feature of the patent.

996,380, June 27, 1911. PROCESS OF PURIFYING TIN SCRAPS PREPARATORY TO DETINNING SAME. Carl Von Der Linde of Crefeld, Germany. A process of removing grease and oil from tin plate scrap by forcing lye solution through a compact mass of the scrap under pressure.

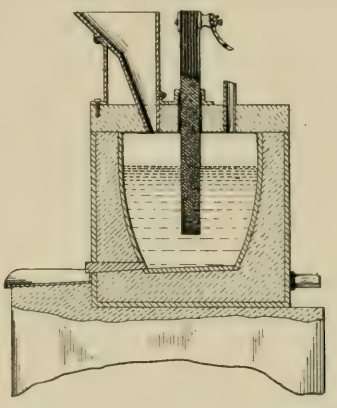
997,293, MACHINE FOR MAKING CORES. Fred Herbert of Birtley, England. The invention is for making cores employed in the casting of pipes. The object is to make the cores rapidly and economically and a perusal of the patent specification is required for a complete understanding of the mechanism.

997,259, July 11, 1911. SELF HEATING SOLDERING IMPLEMENT. Hiram E. Barber of Stamford, Nebraska. A soldering



iron in which the point or soldering-copper is heated by means of gasoline. The gasoline is contained in the handle.

996,094, June 27, 1911. METHOD OF MAKING FUSBILE COMPOUNDS OF ALUMINUM AND RECOVERING ALUMINUM THEREFROM. Lucius Richard Keogh of Ottawa, Canada. Aluminum sul-



phate is heated in a crucible with carbon and on a bath of molten metal such as copper, and at the same time an electric current is passed through. Various conditions are necessary in order to render the process successful

998,379, July 18, 1911. PROCESS OF ELECTROLYTIC REFINING OF ZINC. Kunigoro Namekawa and Jishichiro Miyazawa of Tokyo, Japan. The process consists in using a lead anode and then intermittently reversing the current so that lead peroxide is formed on the anode surface which is of advantage in producing constant deposition of the zinc.

996,590, June 27, 1911. PARTING COMPOUND. Ernst C. Krueger and John W. Mann of Chicago, Ill. A finely ground silicious limestone, that has been decomposed by nature, is treated with linseed oil and then dried at a suitable heat, after which it is finely powdered and sifted. It is used for parting sand molds in place of lycopodium or rosin and charcoal.

988,634, Apr. 4, 1911. METHOD OF ROLLING TUBES. Aloys Fassl of Dinslaken, Germany. A method of rolling tubes by the continuous process. A special grooved roll is used to move the mandrel freely as it passes with the tube through the rolls.

989,731, Apr. 18, 1911. ROLLING MILL GUIDING APPLIANCE FOR WIRE, STRIP METAL, ETC. Carl Tober, of Oberschöneweide, Germany. A device for automatically guiding rods, wire or strip metal when being fed into the rolls for additional rolling.

Trade Items.

The American Optical Co., of Southbridge, Mass., manufacturers of optical goods, have had a decision handed down in their favor in their suit against the Bay State Optical Co. The suit was over an eyeglass guard, which the American Optical Co., claimed was patented by them.

The Salem Brass Foundry of Salem, Mass., of which George Godsland is the proprietor, is to erect a new brass foundry in that city. The present plant will be torn down to make way for the new tracks of the Boston & Maine R. R. The new plant will be located in the suburbs of the city.

The Warner Instrument Co., of Beloit, Wis., manufacturers of automobile speedometers and autometers, have started to build a new brass foundry. It will be 32 x 50 feet and one story high. The present brass foundry will be used for other purposes. This company uses a large amount of bronze castings in the manufacture of their goods.

Dealers and manufacturers in the United States who desire to make foreign connections for potassium cyanide or nickel salts, both single and double, should correspond with the English makers, R. Cruickshank, Ltd., Birmingham, England. Single cases or casks are supplied. The cyanide is in tin lined cases of 112 lbs. net, and in lever lid tins, each containing 28 lbs. net with 4 tins in a case. Lists are sent free and correspondence is solicited.

The Isthmian Canal Commission of the United States Government are desirous of obtaining a brass foundry foreman for the Government brass foundry in the Canal Zone. This foundry is at Gorgona in the Canal Zone and is now turning out about 18,000 lbs. of brass castings per month. The work consists of all classes of locomotive brasses, car bearings, bushings and general machine castings. The furnaces are all heated by oil. Major F. C. Boggs, Corps of Engineers, Chief of Office, Isthmian Canal Commission, Washington, D. C., is the officer to whom correspondence should be addressed.

George S. Youngs, the well known manufacturer of brass and composition ingot, Housatonic Ave and Stella St., Bridgeport, Conn., desires to make connections with anyone having brass or composition chips for sale. As he is a direct user, he prefers to do business with the manufacturer direct as he can afford to pay much better prices for the chips than a dealer can offer. Mr. Youngs manufactures ingot metals exclusively and wishes to state to the trade that he should be allowed to quote prices on the chips before selling them elsewhere. The manufacturer will readily appreciate, therefore, the advantage of corresponding with Mr. Youngs when chips are to be sold. Small and large lots of composition, bronze and brass chips will be purchased at all times.

H. O. Taylor, 654 Fairfield Ave., Bridgeport, who has conducted a plating shop and the manufacture of soft metal novelties, has sold his equipment and plant and discontinued business.

A new brass foundry is to be erected by the Southern Brass Mfg. & Plating Co., at Houston, Texas. This company recently doubled its capital to make the improvements necessary. The company is now occupying a building at 517 Louisiana St. L. M. Rumsey has recently been appointed superintendent of the company.

The Tube Bending & Polishing Machine Co., has been incorporated in Baltimore, Md., for the manufacture of tube bending and polishing machinery. A plant has been leased at Bayard and Carroll Sts., and which will give them ample room for manufacturing. It will be fitted up at once. This company is a reorganization of the Tube Bending Machine Co., of Newark, N. J.

Burton T. Moore, 510 South 57th St., Philadelphia, Pa., is now handling copper bearing material on a large scale and has eight washing machines installed. Mr. Moore states that he has exceptional facilities for the rapid and economical handling of copper bearing material and solicits opportunities to bid on large lots. He was for many years superintendent of the brass foundry department of the Bethlehem Steel Co., of South Bethlehem, Pa.

A meeting of about twenty of the brass sheet and wire manufacturers of Great Britain was held on July 11th, in Birmingham, England. While the proceedings of the meeting were not made public, it is stated that the object was to try to improve prices for sheet brass and wire and prevent the ruinous competition that is now taking place in England. The advisability and possibility of forming an association was discussed but no definite decision was reached. It is stated that further meetings will be held in the near future.

The Munning-Loeb Company has been organized to take over the Loeb Electrochemical Co., of New York City. A. P. Munning and Walter L. Loeb are the organizers of the company and the main office is at Matawan, N. J., where the plant formerly used by the Levett Mfg. Co., has been purchased. The manufacture of electroplating and polishing supplies is carried on, and the highest grade products only will be turned out. Anodes, rouges and polishing compositions, nickel salts and chemicals will be made of the highest purity. The company states that, while the management will be modern and broad gauge, it will be based upon the old fashioned lines of thorough honesty and conscientious service. They now have a large and splendidly equipped plant under the supervision of experts of long experience in the polishing and plating industry.

The Superior Chemical & Mfg. Co., of Aspinwall, Pa., are now manufacturing soldering fluids for the trade. S. E. Hedden is the president of the company and A. E. Hedden, secretary and treasurer.

The Aluminum Foundry Company has been incorporated in Sebring, Ohio, by Fred Baugh and others. The capital stock is $20,000 and the foundry building is to be 50 x 150 feet and aluminum castings are to be made exclusively.

The Abbott Ball Co., 14 Hicks St., Hartford, Conn., manufacturers of steel balls for burnishing metals by tumbling and tumbling barrels for the same use, have opened a New York Office at 96-98 Reade St., New York City.

The Mould Foundry Co., Porter St., Waterbury, Conn., make a specialty of recasting old nickel anodes. They number among their customers, many of the largest concerns in the Naugatuck Valley. In addition to nickel anodes, they recast scrap brass in anode form. George B. Scovill is the manager of the company and has had long experience in this line of work.

M. F. Legge, formerly with the Zucker & Levett & Loeb Co., of New York City, has assumed the management of McLaughlin & Co., 10 Pearl St., Buffalo, N. Y., manufacturers of plating and polishing supplies. This company makes a specialty, in addition to carrying a full line of supplies for the plater and polisher, of the compressed linen polishing wheel.

P. Pryibil, 521 West 41st. St., New York City, is sending out to the trade an extensive and finely illustrated catalogue of his goods. It somprises the metal spinning lathes and accessories that he manufactures and many new and unique devices are embodied in it. The "Pryibil" lathe for spinning has been known to the trade for many years and has earned a just reputation. The catalogue will be sent to those interested.

P. G. Smith, secretary of the J. D. Smith Foundry Supply Co., of Cleveland, Ohio, the well known manufacturers and dealers in foundry supplies and equipment, has taken charge of the Eastern office of the company at 378 Ellicott Square Building, Buffalo, N. Y. All Eastern and Canadian business of the company will now be handled from this point and more careful attention can now be paid to this trade.

C. F. Mosman, for many years chief designer and modeller for Burns, Silver & Co., of Bridgeport, Conn., manufacturer of cabinet hardware, has severed his connection with this company and has started in business for himself. He is located at 706 Laurel Ave., and makes a specialty of designing art metal goods and making the model of the design. Designs for soft metal goods, sterling-silver ware, hollow-ware, ornamental brass goods and metal novelties will be made to order. Mr. Mosman would like to correspond with those who do not have sufficient work to maintain a regular designer.

The Elgin Metal Novelty Co., of Elgin, Ill., manufacturers of metal novelties, has completed plans for a new building. It will be 40 x 200 feet and will cost $20,000.

The Ashton Valve Co., of Boston, Mass., manufacturers of safety valves and steam gauges, have declared their regular quarterly dividend of 2 per cent.

The Iowa Mfg. Co., of Oskaloosa, Iowa, manufacturers of valves, has been taken over by the Iowa Valve Co. Herman W. Read is the secretary and treasurer of the company. The Iowa Mfg. Co. failed some time ago.

The new brass foundry being erected by the General Electric Company at West Lynn, Mass., will be completed in about two months. The foundry comprises one building only so that work can be handled to the best advantage.

The Plumbers' Fixture Mfg. Co., has been incorporated in Cleveland, Ohio, with a capital stock of $15,000 to manufacture plumbers' brass goods. An anti-scalding valve and a basin waste are among the specialties that will be made. The office of the company is at 815 Hippodrome Building, Cleveland.

Maas & Waldstein, the well known lacquer and chemical manufacturers, have leased two acres of land in Niagara Falls, N. Y., from the power company and will erect a fireproof electrochemical plant on it. This will be a separate plant from the one now operated in Newark, N. J. The office of the company will still remain at 100 William St., as usual.

The Cochrane Metal Company has been formed in Bridgeport, Conn., for dealing in old metals and copper bearing materials. The office of the company is now in the Sanford Building. Works will shortly be built in Stratford, Conn., on the line of the N. Y. N. H. & H. R. R. M. M. Cochrane is the proprietor of the company and C. W. Moore, formerly with the Housatonic Metal Co., of Stratford, Conn., is connected with them.

A receiver has been appointed for the Bannatyne Watch Company of Waterbury, Conn. Charles E. Spencer, Jr., has been appointed the temporary receiver with power to carry on the business. The action was taken on the petition of D. Austen Brown of Boston, owner of 110 shares of stock and who claimed that no dividend had been paid. The dissolution of the company is asked. The Bannatyne Watch Company was started a few years ago to manufacture a cheap watch and the factory is located at 31 Canal St.

The Buffalo Aluminum & Bronze Company has been incorporated in Buffalo, N. Y., with a capital stock of $25,000 to make brass, bronze and aluminum castings. The company has taken over the foundry business formerly conducted by the Lundhaven Brass Foundry Co., 41 Letchworth St. The officers of the new company are as follows: President, George W. Morris; E. G. Northrop, vice-president and general manager; and J. G. Keppell, secretary and treasurer. A jobbing foundry business will be carried on.

The Metal Embroidery Hoop Co., has been incorporated in Canton, Ohio, to manufacture metal embroidery hoops.

The state of Wisconsin has just passed a law covering the stamping of gold and silver goods and which is practically the same as that passed in other states.

The New Acme Plating Company, 59 Page St., Providence, R. I., which was recently burned out, are now in full operation again and facilities for carrying on their work have been increased.

The main office of the Alvin Mfg. Co., manufacturers of sterling silver ware, has been moved from New York City to Sag Harbor, N. Y., where the factory is located. The showrooms in Maiden Lane, New York City will be continued as heretofore.

Arthur E. Firth of Auckland, New Zealand is now in this country to exploit a new powder for instantaneous electroplating. The powder is rubbed on the article to be plated. It is stated that the powder is different from others which have been on the market.

At a recent meeting of the directors of the Gray & Dudley Hardware Company of Nashville, Tenn., R. M. Dudley was elected president and W. A. Griswold, superintendent of foundry. This company manufactures hardware and conducts an iron and brass foundry. They also conduct a wholesale hardware business.

The Standard Enameling Co., has been organized in Providence, R. I., to carry on jewelry enameling. This company has taken over the Roberts Mfg. Co., 50 Bagley St., in that city and will carry on the same line of work. The capital stock of the new company is $50,000 and it is organized under the laws of North Dakota.

The Ludlow-Saylor Wire Co., of St. Louis, Mo., manufacturers of wire cloth and ornamental wire and brass work, have taken out a permit for a four story addition to their factory. It will be equipped for the manufacture of wire cloth and will, it is expected, increase the capacity of the plant about fifty per cent.

A receiver has been appointed for the Manistee Watch Co., of Manistee, Mich., and the Michigan Trust Co., of Grand Rapids, Mich., has been appointed receiver. The claim is made that the company has liabilities of $125,000 and that it committed an act of bankruptcy by paying one creditor a judgment and the others with checks which were protested.

The Regal Silver Manufacturing Company has been incorporated in New Haven, Conn., to manufacture silver plated ware and cutlery. The company has been in business for several months, but has now incorporated. The factory is at William and Bradley Sts., New Haven, Conn. M. L. Baker is the president of the company; William Curr, vice-president; and Gustav F. Hemming, secretary and treasurer. Mr. Hemming is well known in the trade as the inventor of cutlery grinding machinery.

The main office of the Aluminum Goods Mfg. Co., has been moved to Manitowoc, Wis.

The Mond Nickel Company is erecting a nickel smelting works at Sudbury, Ont. Canada.

A new plant is to be built by the Lakewood Metal Company of Lakewood, N. J., H. J. Terwilliger is chemist for the company.

Ellis B. Kingsley, for fifteeen years in the employ of the company as engineer, has been appointed general superintendent of the Benedict Mfg. Co., of East Syracuse, N. Y., manufacturers of metal novelties.

Graff, Washburne & Dunn of New York City, manufacturing silversmiths, have won their suit against E. G. Webster & Son of Brooklyn, N. Y., also manufacturers of sterling goods, for design infringement.

The Corona Mfg. & Supply Co., 311 Atlantic Ave., Boston, Mass., is manufacturing a new line of metallic flexible hose that is different from other flexible varieties heretofore made.

The new plant of the Knox Stove Co., on Elliott Ave., Knoxville, Tenn., has been started. This company was recently organized with a capital stock of $100,000 to manufacture stoves. Fifty hands will be employed. About $65,000 has been invested in the plant.

The Ross-Heaton Mfg. Co., of Richmond, Va., manufacturers of automobile curtain fasteners, has been purchased by Detroit, Mich. people and the plant moved to that city. A new company has been organized with a capital stock of $50,000 to take over the business.

The new plant which the Standard Underground Cable Co., of Pittsburgh, Pa., and Perth Amboy, N. J., will erect in Hamilton, Canada is to cost $500,000. A site with a frontage of 400 feet on Sherman Ave. has been purchased. This company manufactures bare and insulated copper wire, lead covered copper cable and brass wire.

The Rockwell Furnace Co., 26 Cortlandt St., New York City, furnace and furnace equipment manufacturers, are sending out to the trade their Bulletin No. 29 describing the "Lalor Automatic Stop-Valve" for use on oil pipe lines. In case there should be a break in the pipe or an abnormal flow of oil to the burners, the stop-valve will automatically cut off the oil. Danger from fire is thus eliminated and the valve fills a want in the oil furnace trade

The Bristol Company of Waterbury, Conn., manufacturers of the "Bristol Recording Instruments" have just issued a very elaborate catalogue of their instruments. It consists of 64 pages in which a complete description of their instruments are given, and contains a large number of illustrations showing the different types of recording instruments made by the company. The pyrometers, recording ammeters and voltmeters made by them are fully described in the catalogue.

The New Departure Mfg. Co., of Bristol, Conn., manufacturers of bells, coaster brakes, automobiles, and many other similar metal goods, are to build a new testing laboratory 30 x 82 feet and two stories high.

The Korff Mfg. Co., of Lansing, Mich., manufacturers of metal specialties, have commenced the erection of a large addition to their works. The plating department will be located in this new addition.

The Southern Brass Mfg. & Plating Co., has been re-organized in Houston, Texas, and the capital stock increased to $24,000. W. S. Farish is the president of the company. No additions to the plant will be made.

The plant of the Yeager-Hunter Stove Works at Spring City, Pa., has been sold by the receivers for $37,500. The sale includes the real estate and property owned by the company.

The Hollander Bros. Co., has been organized in Bridgeport, Conn., to manufacture stamped metal goods and wire specialties. They are located at Spruce St. and Wordin Ave.

The Incandescent Light & Stove Co., of Cincinnati, Ohio, manufacturers of gas stoves, have moved from their old factory on Pearl St., in that city to their new factory in the Oakley district.

The Harshaw, Fuller & Goodwin Co., of Elyria, Ohio, manufacturers of electroplaters' chemicals and nickel anodes as well as a large variety of other products, is erecting a new factory building 125 x 260 feet of brick and steel.

The Muncie Brass & Aluminum Castings Co., has been organized in Muncie, Ind., for the manufacture of brass bronze and aluminum castings for the jobbing trade. J. E. Evans is the secretary and treasurer of the company and it will be located in the foundry now occupied by Patrick Murphy.

The New Standard Hardware Works has succeeded the Universal Hardware Works of Mount Joy, Pa. The manufacture of food choppers and hardware for household use is carried on. The change is one in name only. M. A. Rollman is the president and manager of the company.

The Art Brass & Plating Works recently incorporated in Louisville, Ky., to take over the business of the Apex Mfg. Co., of that city, has elected the following officers: President, Otto Seelbach; vice-president, Carl Rindt; secretary and treasurer, Louis Rindt. The manufacture of plumbers' supplies is to be one of the new lines of the company.

The Stewart & Clark Company of Chicago, Ill., manufacturers of automobile speedometers, are erecting an eight story concrete building at 319 Wells St. in that city at a cost of $200,000. The business of the company will be moved to this address when the new building is completed. They are now located at 500 Diversey Boulevard in that city.

The Union Art Metal Works has started in business at 171 Cooper St., Trenton, N. J., and are carrying on polishing and plating.

The Phoenix Die Casting Co., has been incorporated at 21 Illinois St., Buffalo, N. Y., to manufacture die castings. Henry Bechter is the president.

The Radio Mfg. Co., has been incorporated in Columbus, Ohio with a capital stock of $50,000 to manufacture automobile radiators. Other metal specialties will also be made.

The Aluminum Foundry Co., has been incorporated in Sebring, Ohio, with a capital stock of $20,000. The incorporators are the following: F. Bauch, George Bauch, M. K. Bauch, E. C. Bauch and S. H. Hommell.

It has been stated by U. S. Consul General A. M. Thackara located in Berlin, Germany, that there are now over 12,000 plants in Germany using oxy-acetylene or similar welding apparatus. In Stuttgart there is a school in which instruction in welding is given.

The Keystone Bronze Co., of Pittsburgh, Pa., brass and bronze founders, has placed a contract for an addition to their foundry in New Brighton, Pa. (formerly the Brighton Brass & Bronze Co). This company is the largest manufacturer of bronze blast furnace tuyeres in the United States.

The Imperial Clock Company, clock manufacturers, has purchased a plot of land at 3419 Rutger St., St. Louis, Mo., and will erect a two story building upon it. The plant will then be moved from Granite City, Ill. to St. Louis. The manufacture of electric clocks is carried on. The company was recently incorporated to carry on the business in Missouri.

The Hendee Mfg. Co., of Springfield, Mass., manufacturers of motor-cycles, announces that it will occupy the factory of the Otis Elevator Co., in that city when the latter company moves from it in the early fall. The Hendee Mfg. Co., recently purchased the property from the Otis Elevator Company. A few improvements will be made upon the plant.

The Standard Electric Time Co., of Foxboro, Mass., manufacturer of electric clocks, has been purchased by George L. Riggs of 35 Congress St., Boston, Mass. This company was one owned by the Industrial Instrument Co., of Foxboro and it is expected that it will be moved to Waterbury, Conn., where it was formerly located.

Obituary.

E. A. Bliss, president of the E. A. Bliss Company of Meriden, Conn., manufacturers of metal novelties, died on July 27th, at Magnolia, Mass., aged sixty-three.

Franklin L. Codman of the firm of F. L. & J. C. Codman, Boston, Mass., buff wheel manufacturers, died on July 7th, at his home in Canton, Mass.

Current Metal and Supply Prices.

These Prices are net and are for moderate quantities. Smaller quantities command higher prices. Prices subject to fluctuation.

Acetone, pure, 98-99%	lb.	.22
Acid, Acetic, pure, 30%	lb.	.07
Acid, Arsenious (White Arsenic)	lb.	.20
Acid, Benzoic	lb.	.55
Acid, Boracic (Boric), pure	lb.	.12
Acid, Hydrochloric, see Acid, Muriatic.		
Acid, Hydrofluoric, 30%	lb.	.04
Acid, Hydrofluoric, 50%	lb.	.10
Acid, Muriatic, 20°	lb.	.02
Acid, Muriatic, c. p., 20°	lb.	.07
Acid, Nitric, 38°	lb.	.05⅝
Acid, Nitric, 40°	lb.	.05⅞
Acid, Nitric, 42°	lb.	.06¼
Acid, Nitric, c. p.	lb.	.08
Acid, Sulphuric, 66°	lb.	.01¾
Acid, Sulphuric, c. p.	lb.	.06
Alcohol, Wood	gal.	.50
Alcohol, Denatured	gal.	.55
Alum	lb.	.04
Ammonium Sulphate	lb.	.07
Aluminum, Metallic, in Ingots	lb.	.20¼
Aqua-Fortis, see Acid, Nitric.		
Ammonia Water (Aqua-Ammonia), 20°	lb.	.04¾
Ammonia Water (Aqua-Ammonia), 26°	lb.	.06¼
Ammonia Water, c. p.	lb.	.08
Ammonium Carbonate, lump	lb.	.15
Ammonium Chloride (Sal-Ammoniac)	lb.	.12
Ammonium Hydrosulphuret	lb.	.30
Ammonium Sulphate	lb.	.07
Ammonium Suphocyanate	lb.	.50
Amyl Acetate	gal.	2.75
Antimony	lb.	.08½
Arsenic, Metallic	lb.	.15
Arsenic, White (Acid Arsenious)	lb.	.20
Argols, White (Cream of Tartar)	lb.	.31
Asphaltum, Commercial	lb.	.05
Asphaltum, Egyptian (Bitumen)	lb.	.30
Benzine	gal.	.15
Benzol, Pure	gal.	.75
Bismuth, Metallic	lb.	2.00
Bitumen, see Asphaltum.		
Blue-Vitriol, see Copper Sulphate.		
Borax, Crystals or Powdered	lb.	.10
Borax Glass	lb.	.35
Cadmium, Metallic	lb.	.75
Carbon Bisulphide	lb.	.10
Calcium Carbonate (Precipitated Chalk)	lb	.10
Chrome-Green	lb.	.50
Copper, Lake, (carload)	lb.	.12¾
Copper, Lake, (cask)	lb.	.13
Copper, Electrolytic, (carload)	lb.	.12⅝
Copper, Electrolytic, (cask)	lb.	.12⅞
Copper, Casting, (carload)	lb.	.12½
Copper, Casting, (cask)	lb.	.12¾
Copper Acetate (Verdigris)	lb.	.35
Copper Carbonate, dry	lb.	.25
Copper Sulphate (Blue-Stone)	lb.	.09
Copperas, see Iron Sulphate.		
Corrosive Sublimate, see Mercury Bichloride.		
Cream-Tartar, see Potassium Bitartarate.		
Cryolite	lb.	.12
Cyanide, see Potassium Cyanide.		
Dextrin	lb.	.15
Emery Flour	lb.	.04
Emery, F F & F F F	lb.	.03
Flint, powdered	lb.	.01
Fluor-Spar	lb.	.01¼
Fusel-Oil	gal.	2.75
Gold Chloride	dwt.	.60
Gum Copal	lb.	.30
Gum Guiacum	lb.	.26
Gum Mastic	lb.	.70
Gum Sandarac	lb.	.35
Gum Shellac, brown	lb.	.50
Gum Shellac, white	lb.	.60
Iron Perchloride	lb.	.25
Iron Sulphate (Copperas)	lb.	.05
Lead Acetate (Sugar of Lead)	lb.	.15
Lead, Pig	lb.	.04⅝
Lead, Red	lb.	.12
Lead, Yellow Oxide (Litharge)	lb.	.12
Liver of Sulphur, see Potassium Sulphide.		
Manganese, Ferro, 80%	lb.	.10
Manganese, Metallic, pure	lb.	.75
Magnesium, Metallic	lb.	1.50
Mercury Bichloride (Corrosive Sublimate)	lb.	.93
Mercury, Metallic (Quicksilver)	lb.	.44
Mercury Nitrate	lb.	1.50
Mercury Oxide, yellow	lb.	1.80
Nickel and Ammonium Sulphate (Double Salts)	lb.	.16
Nickel Carbonate, dry	lb.	.60
Nickel Chloride	lb.	.50
Nickel Metallic	lb.	.45
Nickel Sulphate (Single Salts)	lb.	.25
Nitre (Saltpetre), see Potassium Nitrate.		
Oil of Vitriol, see Acid, Sulphuric.		
Paraffine	lb.	.15
Phosphorus, yellow	lb.	.40
Phosphorus, red	lb.	1.10
Pitch	lb.	.05
Plaster of Paris, Dental	bbl.	4.00
Platinum Chloride	oz.	25.00
Platinum Metallic	oz.	44.50
Potash-by-Alcohol, in sticks	lb.	.50
Potash, Caustic (Potassium Hydrate)	lb.	.08
Potassium Bichromate	lb.	.14
Potassium Bitartarate (Cream of Tartar)	lb.	.31
Potassium Carbonate (Pearlash)	lb.	.10
Potassium Chlorate	lb.	.15
Potassium Cyanide	lb.	.25
Potassium Iodide	lb.	2.25
Potassium Nitrate (Nitre or Saltpetre)	lb.	.10
Potassium Permanganate	lb.	.17
Potassium, Red Prussiate	lb.	.60
Potassium, Yellow Prussiate	lb.	.24
Potassium Sulphide (Liver of Sulphur)	lb.	.15
Potassium Sulphuret, see Potassium Sulphide.		
Potassium Sulphocyanate	lb.	.70
Pumice, Ground	lb.	.05
Quartz, Powdered	lb.	.01
Rosin, Yellow	lb.	.04
Sal-Ammoniac, see Ammonium Chloride.		
Sal-Soda, see Sodium Carbonate.		
Silver Chloride, dry	oz.	.75
Silver Cyanide	oz.	1.00
Silver, Fine	oz.	.52⅛
Silver Nitrate, crystals	oz.	.50
Soda-Ash	lb.	.05
Sodium Biborate, see Borax.		
Sodium Bisulphite	lb.	.15
Sodium Carbonate (Sal-Soda), crystals	lb.	.02
Sodium Hydrate (Caustic Soda)	lb.	.05
Sodium Hydrate (Caustic Soda) by Alcohol (in sticks)	lb.	.45
Sodium Hyposulphite ("Hypo")	lb.	.04
Sodium Metallic	lb.	.90
Sodium Nitrate	lb.	.05
Sodium Phosphate	lb.	.09
Sodium Silicate (Water-Glass)	lb.	.04
Soot, Calcined	lb.	.15
Spelter, see Zinc.		
Sugar of Lead, see Lead Acetate.		
Sulphur (Brimstone) in lump	lb.	.05
Tin Chloride	lb.	.43
Tin, Metallic	lb.	.41¾
Turpentine, Venice	lb.	.35
Verdigris, see Copper Acetate.		
Water, Distilled	gal.	.15
Water-Glass, see Sodium Silicate.		
Wax, Beeswax, yellow	lb.	.45
Wax, Carnauba	lb.	.70
Whiting (Ground Chalk)	lb.	.02
Zinc Carbonate, dry	lb.	.19
Zinc Chloride	lb.	.12
Zinc, Sulphate	lb.	.06
Zinc, (spelter)	lb.	.05⅞

THE BRASS WORLD AND PLATERS' GUIDE

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Melting Metals With High Pressure Cas.

The use of high-pressure gas for melting metals, is one of the matters which is creating much interest in England at the present time. We believe that sooner or later it will create a similar interest in our own country. The fact that high-pressure gas mains have been laid in the city of Birmingham, England indicates that the use of high-pressure gas has passed the experimental stage.

The advantage of the use of high-pressure gas lies in the fact that no air blast is necessary or is employed with the gas. A reducing flame is thus obtained and there is practically no noise. These facts were early appreciated and use made of the gas in annealing, blowpipe work etc. Recent applications have been in the melting of brass and aluminum and the results have been very gratifying. An article on the subject ,reprinted elsewhere will explain the situation.

The great advantage in the high-pressure gas in melting lies in the fact that a *reducing flame* is produced so that there is no tendency to oxidize the metal. In fact, oxide is reduced. As loss in melting occurs through oxidation, the employment of high-pressure gas will minimize this loss to the greatest possible degree: in fact, the reports indicate that the loss of zinc in brass melting by this method is much less than when coke furnaces are employed and these have always given the lowest melt loss.

We believe the use of high-pressure gas is well worth investigation by those who have occasion to melt metals.

The Rise in the Price of Fusel-Oil and Amyl-Acetate.

Lacquer consumers will be interested in knowing that the fusel-oil situation has become still more acute and amyl-acetate has now reached a price of $3.00 per gallon with practically none being offered. It can be imagined what this means to the lacquer trade when the price has advanced from about $1.30 to $3.00 per gallon within the short time of eighteen months. Being a waste product, there is no possibility of increasing the production.

There is only about one quart of fusel-oil obtained from 100 gallons of 95% alcohol. It is obtained only from alcohol and the manufacture of whiskey now supplies none. Amyl-acetate is made from fusel-oil.

It can easily be understood that the various grades of lacquer will advance in price anywhere from $0.50 to $1.00 per gallon and will naturally create quite a stir among lacquer consumers. It can also be imagined what it means to the lacquer manufacturer. Suppose he uses 100,000 gallons of fusel-oil per year, which is a comparatively small quantity. This amount, eighteen months ago cost him $130,000. Fusel-oil is sold only against draft and the same amount to-day will cost him $300,000. The amount of money necessary to carry on the transaction can easily be appreciated. Suppose the manufacturer carries 20,000 gallons of stock worth $60,000. Should the price break to $1.50 per gallon, he would suffer an inventory loss of $30,000. If the consumer who complains of the price he has to pay for his lacquer could realize the chance the manufacturer is obliged to take, possibly his lot would not seem so hard.

The Frequency of Blistering as a Cause of "Spotting-Out."

While castings are the most frequent cause of spotting-out, a form of this difficulty occurs on sheet metal, rod and wire goods which are, in reality, sound and free from pores. In the case of castings, the spotting-out occurs on account of the cavities in the metal holding back solution which penetrated during the plating operation, and then expelling it again upon exposure to the air. In the case of sheet metal goods, or those made of rod, wire or tubing, there is no porosity so that the spotting-out cannot take place under the same conditions as those of the castings. Spots are a very frequent occurrence, however, on this kind of goods, but the cause is blisters and not porosity.

The spotting-out, on account of blistering, is characteristic of copper or brass plated goods. If the surface of the metal to be plated is not clean, or the current is too strong, or there is too much free cyanide in the solution, small blisters form underneath the deposit. These may be large or small as the conditions admit, but in either instance the result is the same. The blisters hold plating solution underneath and as time goes on after the plating has been finished, it works out and corrodes the metal and attacks the lacquer over it. This may take some time and it is not infrequent to discover that the spots make their appearance many months after the goods have been finished and shipped to a customer.

Spotting-out on account of blisters usually takes place on smooth surfaces. It is a singular fact that dead or rough surfaces do not blister when copper or brass-plated. The smooth or polished surface is the one that gives the trouble.

The spotting-out of such polished goods occurs in certain portions of the surface and is more or less irregular. If examined with a magnifying glass, a large number of minute, round spots will be discerned, resembling, more than anything else, a lot of fly specks. Each one of the specks is a blister and the plating solution entrapped underneath has worked out, staining the surface. Unlike the spotting-out of castings, these specks do not grow to any extent as there is so little solution in the blisters, but there is a sufficient quantity to cause a bad staining of the surface.

The remedy for the blistering is to avoid using too strong a current. The gas given from the surface of the work being copper or brass plated, should be small and just barely be evolved from the metal. If a rapid evolution is had, then blistering is more apt to take place.

The cleaning of the work is of great importance in preventing blistering. Grease on the surface prevents the adherence of the deposit and solution is thus entrapped only to work out at a later time.

The Application of Graphite to the Production of Crucibles for Melting Metals.*

Graphite has found a wide and important technical application in the manufacture of graphite crucibles used for melting metals. This application of graphite is much older than the lead pencil industry and dates back about 500 years, for in 1494-1555, Agricola mentions the refractory nature of the Passau crucible and the Italian Emperor Ferrante mentioned them in 1599.

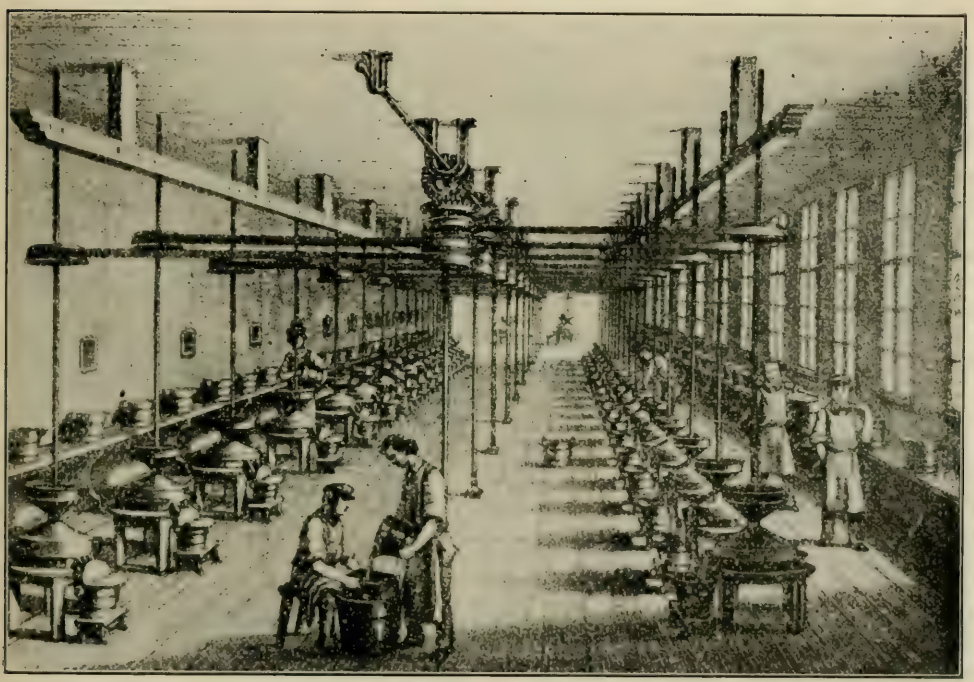


Fig. 1. German Graphite Mills for Grinding the Graphite.

The graphite crucible belongs to a group of carbon containing crucibles which are especially serviceable on account of their refractory nature. The addition of graphite to a crucible appears indispensable in the melting of metals, particularly in the manufacture of tool-steel, for the reason that it is not combustible itself, nor does it have any action on the clay mixed with it for forming the crucible. In addition, it prevents the oxidation of the molten metal in the crucible, particularly in the case of alloys and in such instances a clay crucible would be fluxed or attacked by the oxide of the metal being melted. It should be understood that it is the oxide of the metal and not the metal itself that attacks the clay of the crucible and fluxes it. As the graphite is infusible it increases the refractory nature of the clay mixed with it in the making of the crucible.

With the increasing content of graphite in the crucible, the clay used with it decreases in binding quality and becomes too brittle for use. The proportion of the two must be uniformly maintained in order that the crucible be satisfactory. The advantage of as large an amount as possible of the graphite in a crucible is that the heat conductivity is thereby increased and rapid heating of the metal in it then follows with a corresponding decrease in the cost of melting. Such cruci-

*Abstract Translation from the German monograph *"Der Graphit,"* by A Haenig.

bles containing graphite bear sudden changes in temperature much better than those made of clay alone and finally, the metal melted in them is more readily poured as the graphite renders the walls smooth.

In the choice of graphite for crucibles it should be observed that the best quality is that which burns with the most difficulty and leaves the least ash. A high ash content diminishes the refractory nature of the clay used with the graphite in making the crucible. Further, the graphite should possess a foliated structure as thereby a parallel cleavage is secured in the crucibles and in this respect a good Ceylon graphite is the best. The flaky nature, the refractory property and the low ash content are the principal qualifications necessary for the production of a good crucible. It may be said that the demand for a particularly refractory clay is no longer necessary.

When the crucibles are heated, the graphite burns out on the surface and they acquire a gray or reddish color. In order that the graphite be not fully burned out and so made useless, it is desirable that the surface be covered with a protecting coating. This, however, is more easily formed by the action of the ash of the fuel with a less refractory fire-clay than with one of a high fusibility, and as previously mentioned, a less fusible clay is preferable. Naturally a glazing of this kind must form very rapidly and to facilitate it, from 3 to 5 per-cent of feldspar are added to the clay to render it sufficiently fusible so that the surface of the crucible will glaze over when heated. For a quicker glazing, the surface of the crucible is coated, after burning, with a soda solution or one of water-glass.

As the best clays for the manufacture of crucible mixtures, may be mentioned the Klinenberger, Grosalmeroder, Grünstädter or Kärlischer varieties:

Explanation of Table 1.

1. Klingenberger Clay. Selected.
2. Klingenberger Clay. Common Grade.
3. Klingenberger Clay. Common Grade.
4. Passauer Clay.
5. Grosalmerode Clay. Special Grade.
6. Grosalmerode Clay. Best Grade.
7. Grünstadt Clay. Selected.

*Magnesia estimated with the lime.

Ceylon graphite is prepared in such a manner that it breaks up into small flakes which is considered very desirable for the formation of a parallel structure in the crucible mass. If it is found on burning the crucible material that it breaks easily this may be overcome by the further addition of fire-brick or old crucibles, or the addition of a little graphite. To lessen the shrinkage, sand or quartz is added in small amounts which, moreover, is found in a finely divided condition in the best German graphite, and is on this account preferred for the manufacture of crucibles.

Whatever the composition of the graphite is, the clay is adjusted to correspond to it. As a general rule, one can figure on 1 part of graphite to 3 parts of clay. Bruno Kerl gives the following mixtures in his handbook for the crucible industry:

To 1 part by weight of clay, including ground-fire brick and quartz, 1 part of graphite, or more exactly to 75 parts of clay about 25 parts of quartz (or somewhat less of ground fire-brick), 80 to 100 parts of graphite are used. If quartz is used, it should be free from dust and in the form of small uniform grains about the size of a pin-head, which is often previously heated strongly in an iron kettle. If the demands of the crucible are excessive, then the graphite used in it must be freed from dust.

The following mixtures are mentioned for graphite crucibles (mostly older mixtures):

Table 1.

	1	2	3	4	5	6	7
Silica	54.06%	56.62%	47.49%	47.10%	65.98%	46.37%	47.33%
Alumina	33.11%	29.09%	34.94%	34.65%	23.37%	35.62%	35.05%
Iron Oxide	1.50%	1.78%	2.63%	2.70%	2.32%	2.35%	2.30%
Lime	0.49%	0.73%*	1.04%*	1.10%*	0.41%	0.88%*	0.16%
Magnesia	0.45%	.....	.....	.....	0.53%	.....	1.11%
Potash	1.37%	0.79%	1.13%	2.17%	0.76%	1.80%	3.19
Loss on Ignition	9.12%	11.03%	12.77%	12.28%	6.84%	12.98%	10.51%

1. Passauer or Ypser contain "Hafnerzeller" graphite (with 50 to 65 per cent of earthy material), Ceylon graphite and ½ to 1/3 of Passauer clay.

2. The "Achenrainer" crucible consists of Passauer clay and graphite with the addition of broken crucibles; or one employs broken crucibles alone (so called crucible-sand) and adds 1/3 Passauer clay to it.

3. The crucibles of the Plumbago Crucible Co., consist of about equal parts of Stourbridge clay and Ceylon graphite and contain about 52.6% of carbon.

4. Soft and tough crucibles from Birmingham, England contain 2 parts of the best Stourbridge clay, 3 parts of graphite and 1 part of broken crucibles of 3mm grains.

course, only the flaky pieces. The graphite is ground in a peculiar ball mill and then mixed with small amount of kaolin according to the different applications of the crucible. For 10 parts by weight of graphite, including kaolin, 7 parts of Klingenberger clay are used and a small addition of charcoal in order to keep the mass somewhat porous.

The practice for the preparation of crucibles in the factory of the Joseph Dixon Crucible Company in Jersey City, (North America) which employs the Ticonderoga* graphite, is as follows:

The flake graphite is ground in a ball mill, according to the purpose to which the crucibles are to be used, the graphite thus ground is mixed with kaolin in varying quantities,

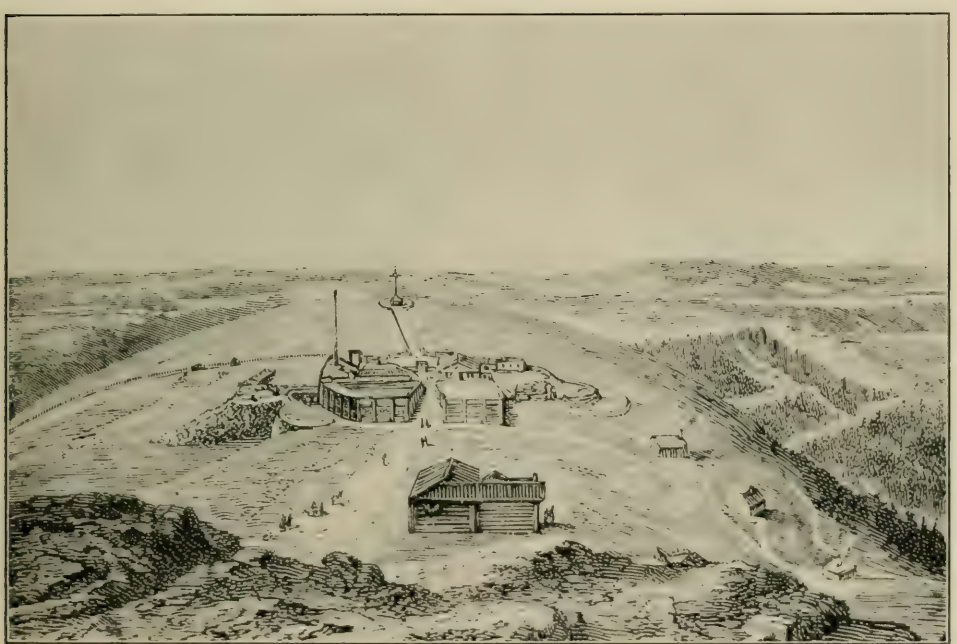


Fig. 2. A Siberian Graphite Mine.

5. The well known "Duisberger" crucibles, which give 13 heats in steel melting, consist of 7 parts of a compactly burning clay of a melting point of about Segarcone No. 30, 4 parts of the best pulverized Ceylon graphite and 1 part of ground fire-brick the size of poppy-seeds. Bischof found in unburned pieces of this crucible, 8 parts of clay including 1 part of fine fire-brick and 4 parts of graphite.

6. For American crucibles* the best graphite from Ticonderoga is employed and, of

besides 10 parts of graphite and 7 parts of gray clay from Klingenberg in Bavaria and some pulverized charcoal, the latter to secure porosity. The mass is then moistened with water and kneaded in a vertical cylinder. The radial arms of this cylinder are attached to the axis, each of which is provided with four knives so that a quite uniform mixture is secured. The form of the crucible is made

*This is erroneous. Ceylon graphite is used in all American crucibles.—*Editor.*

either on the potter's wheel by hand or in with a press. The first method is employed only in the making of larger shapes.

The burning of the dry crucibles is carried out in kilns of refractory clay, from 60,000 to 80,000 numbers being placed in the kilns at a time. By a number, a crucible mass of 907 grams is understood. By the burning, the crucibles become hard and acquire a gray-white or blue-gray color, which, however, is no criterion of their value.

Crucibles are made holding from 60 grams to 300 kilograms (2 oz. to 660 lbs.) of metal. Those used for melting brass give 35 to 45 heats while a clay crucible can be used but once.

In melting steel, they give from 4 to 6 heats and still more if they are covered with a mixture of clay, graphite, gas-coke and fine quartz sand. The slag must, above all things, must be carefully chipped off after each operation or heat. Graphite crucibles are kept constantly in dry rooms as even the slightest moisture is destructive to them. It is also well to heat them slowly and to put in the fuel so that it is up to the rim of the crucible.

7. Graphite crucibles from Grosalmerode consist of the best local clay with the addition of the purest Ceylon graphite, which has taken the place of the previously used Passauer graphite.

8. For the melting of a lead and arsenic free ore of antimony with iron, crucibles are used in England of a mixture of Stourbridge clay or Hexamton clay with graphite and contain about 204 parts by weight of clay and 44.5 parts of graphite.

9. For crucible steel melting, the graphite crucible mass must be adapted to the steel as carbon is taken up during the melting. For hard steel a common mixture is 54 parts of graphite, 36 parts of clay and 10 parts of old fire-brick. For soft steel, 40 parts of graphite, 38 parts of clay and 22 parts of old fire-brick.

10. According to Ledebur, crucibles for the melting of steel are made in Styria and Lower Austria from Styrian graphite and clay with the addition of ground crucibles (old). For soft steel, the crucibles contain about 25% of pure carbon, while the carbon content for the melting of hard steel runs up to about 45 per cent. Another kind contains 50 parts of graphite, 45 parts of refractory clay and 5 parts of sand. Crucibles from this mixture which, by the way, hold from 25 to 40 kilos of steel (55 to 88 lbs.) run from 6 to 8 heats.

11. In Hanston, crucibles are made of a mixture containing coke and about 4 parts of Stourbridge clay, 3 parts of graphite, 2 parts of hard coke (or retort-graphite) and 1 part of ground crucibles are used. All go through a sieve of about 3 mm mesh. These crucibles run from 14 to 16 heats in the melting of steel.

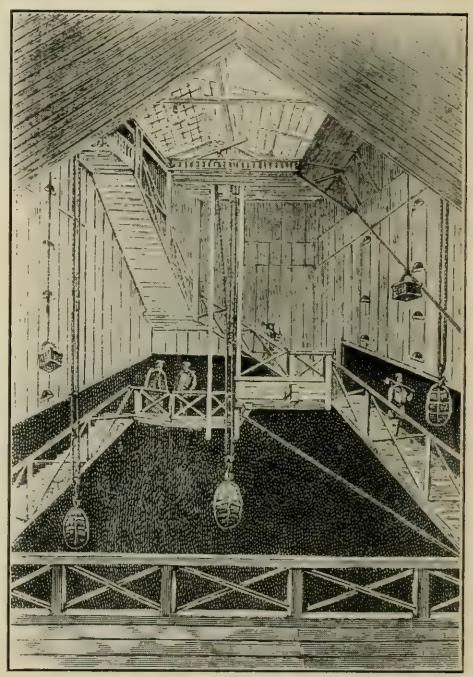


Fig. 3. Entrance to a German Graphite Mine.

12. French crucibles for the region of the Loire also contain coke. There are used, 6 parts of clay from Mussidan (Gironde) or Paignol (Haute-Vienne) which is mixed with 7 parts of ground, old fire-brick of the same clay. It is then put through a sieve of 50 mesh per square centimeter to remove the lumps and to this mass is then added 4 parts by weight of graphite, 1 part of ground crucibles and 1 part of hard coke.

13. According to Mené, English graphite crucibles contain the following:

Silica	51.40%	45.10%	50.00%
Alumina	22.00%	16.65%	20.00%
Oxide of Iron	3.50%	0.95%	1.50%
Graphite	20.00%	34.50%	25.50%
Lime	0.20%	none	none
Water	1.80%	2.50%	3.00%
Total	98.90%	99.70%	100.00%

More recent analyses show the following:

	Grosal-meroder	*Rhein-ischer*	*Dussel-dorfer*
Silica	25.91%	33.44%	34.03%
Alumina	11.26%	17.50%	12.95%
Lime, Magnesia	trace	trace	trace
Iron Oxide	0.48%	undeter	undeter
Graphite	58.24%	48.15%	50.18%
Water	2.77%	0.77%	1.63%

	German Steel Crucible Used 18 Heats	Morgan (London)	English Crucible	American
Silica	32.67%	37.09%	31.40%	31.31%
Alumina	11.52%	14.58%	19.57%	17.30%
Iron Oxide	2.79%	undeter	1.78%	undeter
Lime Magnesia	undeter	undeter	1.10%	undeter
Graphite	48.08%	44.40%	42.08%	47.40%
Water	1.50%	2.92%	1.20%	3.42%
Total	97.16%	98.99%	97.13%	99.43%

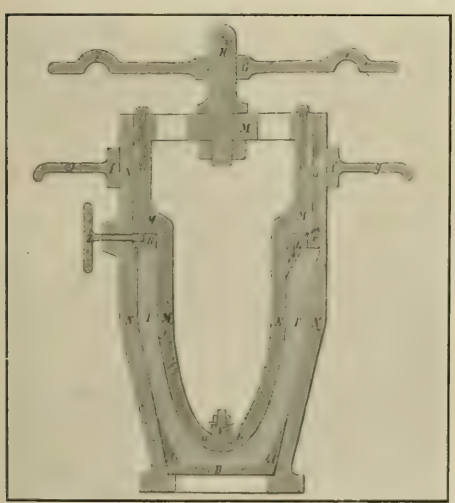


Fig. 4. Sketch of the Monk and Nun Apparatus.

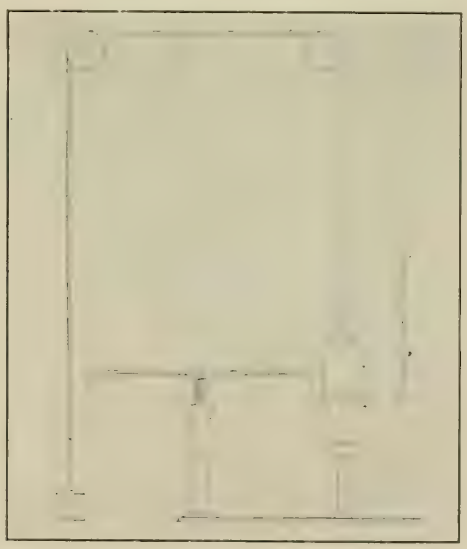


Fig. 5. Setting the Finished Crucible Upon the Wooden Post.

In the manufacture of graphite crucibles, first of all, the crucible mass is prepared. This follows after the clay has been dried, purified and ground. Through the agency of fine sieves, the ground mass is sifted into a fine powder form. For the fire-brick preparation, burnt fire-bricks are ground or granulated. The graphite is ground or pulverized in the form of small flakes and then sifted. After this the ingredients of the crucible mixture are mixed dry and then sifted dry, after which it is wet with water and then brought into a tumbling barrel or clay mill. After it has been made into a stiff dough, it is allowed to remain some days or weeks in a cellar so that the mass will become thoroughly moistened with the moisture in it. This is called the rotting or fermenting of the clay. When this has been accomplished, the mass is made homogeneous by kneading or in a clay mill and then cut up into masses (of about 13 kilos or 32 lbs.) of a size necessary for the formation of a crucible.

The forming of the crucible is done by the stamping or pressing of the crucible mass in metal forms, lined with wood, (the metal is cast iron), or as now extensively used, the potters' wheel, either by forming or spinning in a plaster mold or pattern.

In forming the crucibles in the mold, they are pressed by wooden forms (so-called punches) corresponding to the size of the crucible and the outside turned off on the wheel. In forming crucibles on the press, the bottom of the mold is first covered with graphite upon which the mass of clay is forcibly thrown. By means of a wooden rammer, moistened with water, the crucible is rammed into the mold until the walls are formed. Now the rammer is withdrawn and small balls of the crucible mass are thrown in and the whole worked up into the shape of the crucible. An iron-bound mold is now applied to the surface of the crucible and finishes it.

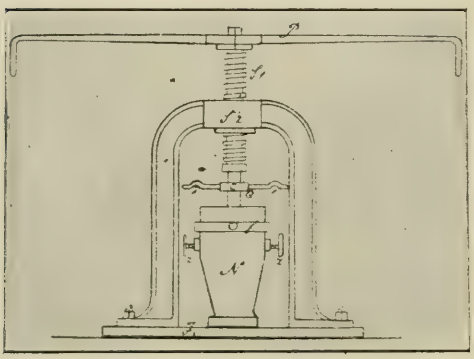


Fig. 6. A Crucible in the Press.

By pressing, the crucible mass is brought in to an iron form (called a "Nonne" or "Nun") and the form (called a "Mönch" or "Monk") is pressed with the hand. In making larger crucibles this is often driven down by hammer-blows and in crucibles for steel melting, of the larger sort, it is formed down by a ram.

In case of larger crucibles, the wooden "Nun" sometimes consists of several parts held together by rings and covered with cloth which are taken apart after the action of the "Monk" and then the cloth which clings to the crucible is separated.

(Te Be Continued)

The local shrinkage or "sinking" of steam-metal castings is usually caused by the lack of the necessary amount of tin in the mixture. Tin prevents this shrinkage.

Extraction of Gases from Copper by Heating in a Vacuum.

If copper be heated in a vacuum the evolution of gas at first is considerable says M. Guichard in *Comptes Rendus* 1911, 153, page 104, but decreases after a time and remains fairly content for many hours.

For example, a copper wire heated for seven hours at 630° C evolved 8.5 c.c. of gas, and during the next hour 0.078 c.c. while during the following 14 hours the evolution amounted only to 0.022 c c. per hour. If the copper is not allowed to cool and again heated, a further evolution results. The gas only appears to be removed from the superficial layer of copper. It is impossible to remove the gas rapidly from melted copper by means of a vacuum, owing to the increased solubility of the gases. The authors say that gases from different kinds of copper contained from 33 to 75 per cent of carbon dioxide and from 9 to 12 per cent of carbon monoxide, the remainder being composed of hydrogen and nitrogen.

Melting Brass and Aluminum with High-Pressure Gas.

The following report by U. S. Consul Albert Halstead of Birmingham, England on the use of high-pressure gas for melting brass and other metals is of interest and indicates that a very low melt loss may be obtained. The report is from the *Daily Consular and Trade Reports*. He says:

"In 1910 the Birmingham, (England) municipal gas department installed a high-pressure gas service for industrial purposes in some parts of the city. A paper in the Iron and Coal Trades Review for June 23 discusses the methods of using the gas and reviews the results to date.

In brass melting the loss of zinc is only 75 per cent of the loss in coke-heated furnaces. Loss by oxidation in melting copper is done away with altogether, the atmosphere in the furnace being a reducing one. The number of heats to be obtained from the pots is increased, and in case of a spill into the furnace there is less difficulty in dealing with the spilled metal than is the case when the metal falls into the coke. Heats can be regulated to a nicety.

One company in Birmingham melts on an average 17 tons of aluminum alloys per week, and of this amount over 7 tons are now melted by high-pressure gas in furnaces, the rest being melted in coke furnaces. The company, however, is about to convert all of its furnaces to high-pressure gas. The type of furnace used by this company has a loose bottom and is heated by means of eight jets, facing tangentially with the inner side of the furnace—four jets on either side. The cost of melting, week in and week out, is 12s. ($2.92) per ton. The manager states that the labor costs are halved, the cost of melting is more than halved, the amount of metal melted per pot is much increased, and there is less oxidation during the melt. The method is much cleaner, there is no carting of ashes, heats are easily and simply controlled, there is a more even alloy, the tensile strength of the alloy is increased, there is a saving in the rebuilding of the linings; and, lastly, the new method is much preferred by the furnace men.

In the Birmingham gas department high-pressure foundry aluminum is being melted at a cost as low as $1.46 a ton. With gas at 30 to 36 cents per 1,000 cubic feet, there should be a great future for it industrially."

Distillation of Tin in a Vacuum.

According to E. Tiede and F. Fischer in *Berichte,* 1911. 44, page 1711, tin has a very high boiling point although its melting point is low. Its distillation in a vacuum is a very difficult matter. The melting point of tin is 230° C. (446° F).

The authors succeeded, however, in distilling several grams of tin in a vacuum by using an electrically heated magnesia crucible or porcelain tube. The heating coil of platinum was wrapped around the tube and the whole placed in an exhausted glass vessel whose outer walls were well cooled by flowing water. The first product of the distillation was a yellow deposit which gradually darkened and became black. This yellow powder, which was found in all varieties of tin, appears to possess all the properties of sulphide of tin (stannous sulphide). If, however, the tin is first prepared so as to be free from sulphur, only a black distillate of pure tin is obtained.

The Effect of Bronze Mixtures on the Production of Dark Verde Finishes.

The most beautiful of the verde-antique finishes are those which are dark. The smooth high-lights of an article of this kind are of a very dark green, almost black, while the background has the dark green, slightly rough surface. Such articles are found in existence and are usually produced by nature. The dark color is usually found on true bronzes. While the light verdes are also found, they are not as beautiful as those which have the rich, dark green color.

Japanese Vase Showing Dark Verde Produced by the Lead in the Bronze.

The production of dark verde has always been one of the difficulties of the art of metal finishing. Solution after solution has been tried, but the results on ordinary work seemed to be the same. The verde thus produced was almost invariably too light, although it was the best that could be produced and was allowed to serve as the desired finish. Once in a while, a good dark verde could be produced, and then, without knowing the circumstances, the special method of treatment was considered as the reason. The finish, however, could rarely be duplicated on other work.

In experimenting with the various solutions and methods for the production of the verdes, the results were all about the same. Bronze worked the best, copper next and brass the worst. It was quite difficult to obtain the desired dark color, and after much labor the problem was abandoned for a time. Some time afterwards the Japanese vase shown in the illustration had to be repaired by soldering and the original finish was injured. It was, therefore, necessary to clean it off entirely and refinish it.

Whether it was possible to reproduce the original dark verde on the vase was doubted, but when the work was completed, the result was a matter of surprise. The dark verde was readily formed and with the same solution that would give only a light verde on other metals. *The reason for the easy formation of the dark verde was found to be the large amount of lead in the bronze of which the vase was composed.*

The fact that Japanese and ancient bronzes contain a large amount of lead is a fact well known. The following analyses will indicate the mixture of which they are composed:

Copper	76.60%	68.25%
Lead	11.88%	17.06%
Tin	4.38%	5.47%
Zinc	6.53%	8.88%
Antimony	none	0.34%

It is well known that bronzes high in lead take a richer *patina* when exposed to the air than those which contain little or no lead. The production of the verde finish is simply the formation of a patina so that it is quite reasonable that a bronze with a large amount of lead should take a dark verde readily. While ordinary bronze contains lead, it is usually customary among brass founders to use as little lead as possible on account of the difficulty in casting. The average mixture employed for casting bronze statues and similar ornamental bronze work is as follows:

Copper	90%
Tin	7%
Zinc	2%
Lead	1%

It will readily be appreciated, therefore, that with a bronze containing so little lead, the production of a dark verde is difficult.

In conclusion, let it be said that the presence of a large quantity of lead in bronze seems to be the secret of the production of a dark verde and the solution itself is not, as usually supposed, capable of forming it.

The solution used for producing the dark verde on the vase was one that has given good results in the production of light and medium verdes. As it may be of interest to those who have not had access to previous articles on the subject, the proportions employed are as follows:

Water	1 gallon
Sulphate of Copper	8 oz.
Sal-Ammoniac	8 oz.
Common-Salt	4 oz.
28° Acetic Acid	2 oz.
Chloride of Zinc	1 oz.
Glycerine	1 oz.

The solution is used as hot as possible and the bronze article dipped into it and allowed to remain for ten or fifteen minutes. The solution is then allowed to cool with the article in it and then it is taken out, without rinsing, and allowed to dry spontaneously. The verde will make its appearance when dry. The surface is then brushed with a stiff, bristle brush to remove the roughness from the high-lights and the whole may then be waxed or lacquered to complete the finish.

Correspondence.

The Fusel-Oil Situation.

The following communication is from an importer of fusel-oil who is quite familiar with the trade situation of this material at the present time and will indicate the condition of the market as regards the supply. The recent rise of fusel-oil and amyl-acetate to $3.00 per gallon has brought about a peculiar situation which is fully explained.

Editor:

Nothing has ever happened in the lacquer business to cause such a complete upset of all plans as the present fusel-oil market. I know nothing to compare with it except the advance in copper to 24 cents.

Fusel-oil is peculiarly adapted to speculation, because when a corner is formed any increased amount cannot be produced. Higher prices increase the supply somewhat due to the greater care being used at the distillery in washing the oil, and the high price will also cause small distillers to save their oil, even if it amounts to only a few barrels a year.

Almost the entire foreign supply of American oil now comes from Russia. Until a few years ago most of it came from Germany, but in recent years they have used more and more of their own production and this last year Germany actually imported some fusel-oil. About three or four years ago, the Russian Government permitted the saving of fusel-oil, and in Russia the Government provides distilleries to which the farmers and others can send their mash or crude alcohol and refines it for them. These Government distilleries handle about three-fourths of the Russian oil, and the Russians themselves, are interested in the present corner of fusel-oil, though there are others interested in various sections of Europe. The headquarters of the corner being in London. You can see therefore that these people have both brains and financial backing and they would probably be tempted to destroy oil before they gave in in the matter of price. To attempt to break these people down financially would be a pretty big undertaking. There is only one way to break the corner, that is to allow the price to go up to a point where people will not buy when the natural production of oil will run ahead of the demand and the surplus of oil accumulate. The present high and excessive prices are aided by the fact that winter will soon be here and in the cold climate of Russia the distillers cannot very well wash out the fusel-oil on account of it freezing up on them in the washing operation. Also transportation in the remote parts of that country is badly interrupted in winter. There is every prospect of the present high prices lasting until next summer at least.

I have given you these points because the increase in lacquer is going to cost the metal trade hundreds of thousands of dollars and a matter of such importance naturally attracts attention. I have given you the various facts regarding source of supply, etc., because these facts are hard to get hold of and as a rule are known only to the very largest buyers of this material.

Respectfully yours,

Importer.

A plant for the manufacture of celluloid was recently started in Japan and is now in successful operation. The output is about 1 ton a day.

"Windsor-Locks" Molding Sand and Its Use.

A variety of molding sand known as "Windsor-Locks" is now extensively used in the manufacture of fine brass castings. It is the sand that the makers of the finest work use and is capable of producing a very fine surface on the brass.

The name "Windsor-Locks" was given this sand for the reason that it was originally mined in Windsor-Locks, Conn., a small village situated above Hartford, Conn., on the banks of the Connecticut River. This sand, however, is now mined in a number of localities in the Connecticut Valley as the soil seems to be about the same for many miles around the Windsor-Locks vicinity. Even though obtained from other towns, the name of "Windsor-Locks" is still applied to the sand.

"Windsor-Locks" sand is a fine, red sand which does not have the full plastic or adhesive nature of ordinary molding sand. For this reason it cannot be used for the entire mold. It is used only as a facing and the mold is then backed up with ordinary molding sand. The object is to just cover the face of the pattern with the "Windsor-Locks" sand so that the metal will come in contact with it, while the strength and necessary porosity of the mold are given by the ordinary molding sand of which the mold is made. The "Windsor-Locks" sand is so fine that were the molds made of it, or too much used, proper vent for the gases generated during the pouring would not be had.

In using "Windsor-Locks" sand for molding, the pattern is faced with it and then the remainder of the mold made with the regular bench sand. To obtain the best results, the face of the mold should be skin dried by placing it before a stove or other suitable means. This, of course, does not mean that the mold shall be dried clear through, but only on the face. The object is to remove the greater part of the moisture in the sand so that the metal will run well without blowing and every part of the mold will be filled. If the finest quality of brass or bronze castings is desired, this skin-drying is necessary.

Nearly all the manufacturers in the East, who make fine brass castings, use "Windsor-Locks" for facing their molds and its value lies in the fact that while it is fine, it does

not contain so much clay as to stop the pores and prevent the gases from penetrating it. In addition, it seems to have the property of resisting the heat of the metal without fluxing, and a fine, clean surface is given the metal. The sand seems to result from the decomposition of the red sandstone of the Connecticut Valley, which is the principal rock of this locality.

Growth of the Ingot Brass Trade.

The manufacture of ingot brass is a trade that has rapidly increased within the past year or two and the reason for it is the supply of good, honest ingot metals. For a number of years brass founders shunned ingot metal for the reason that their previous experience had been such as to warrant the complete abandoning of its use. At that time, unscrupulous ingot makers melted anything that had the color of brass and it mattered not whether iron, antimony aluminum or any other foreign metals were in it. This, of course, reacted against them in a short time and the "goose that laid the golden egg" was killed. After an experience of this kind many brass founders still firmly refuse to use any ingot metal, but make all mixtures from new materials, while others have fallen into line and now buy ingot brass.

Within a year or two, the ingot brass trade has undergone a change. Honest makers have entered the field and are producing a good metal with the result that they have found large and constant customers for their products. In the manufacture of ingot metals, uniformity is quite imperative and unless this is maintained, the consumer loses confidence in the maker and his trade may be lost altogether.

The ingot brass trade has now arrived at the same condition of many other lines of trade. That is to deal with honest, reputable people who have the knowledge and facilities for turning out good, straight ingot metals that will not vary in quality. A customer who is able to obtain goods of this character usually remains permanent.

The number of the United States patents has now passed the million mark and patent No. 1,000,000 has been issued to Francis H. Holton of Akron, Ohio for a vehicle tire.

The Pitting of Nickel Deposits and Their Prevention.

The pitting of an electrodeposit of nickel is one of the difficulties encountered in the art of nickel plating. It is also one of the most annoying and many a piece of work, otherwise perfect, has either been spoiled or rendered unsightly by the pit marks.

The cause of the pitting of a nickel deposit is the formation of minute bubbles of gas on the surface of the metal that is being plated. All plating solutions give off gas when the electrodeposition is going on, but some give off such a small quantity as to be almost imperceptible, while in other instances a considerable quantity is given off. In the case of a nickel solution, the amount of gas given off at the ordinary current density employed for the purpose, is very small and can scarcely be noticed. Gas is given off, nevertheless, as may be found by careful watching of the solution. This gas starts from the surface of the metal being plated, and gradually grows larger until the bubbles detach themselves and pass upward through the solution.

These bubbles are hydrogen gas and when they cling to the surface of the work, the nickel is prevented from depositing in the spot where they cling, but, at the same time deposits around them with the formation of depressions on the surface known as "pits". It is a singular fact that the pits are produced more by a light evolution of bubbles than a rapid one. If the evolution of gas is strong, the gas does not hang long to the surface and a rough deposit is produced rather than one that is pitted. In case the evolution of gas is slow, however, and the bubbles of gas remain on the surface for some time, pits are sure to form.

There are several causes that will bring on the pitting of nickel deposits, but all of them are followed by the secondary cause of the formation of gas on the surface of the metal. While the primary cause may differ, the secondary cause is always the same. The following are the causes of gas formation in quantities sufficient to produce pitting.

1. Too strong a current. This causes gas to form in considerable quantities, but may usually be known by the "burning" of the nickel on the edges. The remedy, of course, is to reduce the current.

2. Lack of sufficient nickel in the solution. This gives an excess of ammonium salts in it

and gas is more apt to form on the work. The remedy is to add single salts.

3. Solution too acid with sulphuric acid. This causes the solution to act on steel or iron work so as to produce gas by local action. The remedy is to add carbonate of nickel to reduce the acidity.

Boracic Acid for Preventing Pitting.

Boracic acid is a very serviceable substance for preventing pitting and will frequently overcome cases which cannot be prevented in any other way. Just why it should prevent the pitting is not well understood, but it seems to prevent the evolution of gas and thus pitting does not take place. A small quantity of boracic acid will have a beneficial effect on the solution but will not overcome the pitting entirely. To prevent it, a large quantity of the substance should be added. The following is the best solution:

Nickel Plating Solution.... 1 gallon
Boracic Acid ..... 5 oz.

The boracic acid will not dissolve in the cold solution but a portion of it should be taken out and boiled with the acid until it is dissolved when it is added to the remainder. The solution when cold is ready for use.

Those who have difficulty with pitting, should try the boracic acid as it will be found particularly efficacious for still solutions and will usually cure an obstinate case of pitting. The advantage is so pronounced that the stoppage of gas evolution from the surface of the work may be noticed as soon as the boracic acid is introduced.

In addition to the advantage of boracic acid for the prevention of pitting, it produces a white and soft deposit that is quite easily buffed and is satisfactory in every way.

Agitated Solutions for Preventing Pitting.

Agitated solutions are an excellent remedy for pitting and it is for that reason that no pitting ever takes place in a plating barrel. The reason is simple: The gas is brushed or jarred from the surface of the work.

The use of boracic acid is always recommended in a nickel solution, either when employed in a plating barrel or as a still solution. With the boracic acid and an agitated solution there is never any danger of pitting, but the use of boracic acid will usually suffice to overcome an obstinate case. Agitated solutions, of course, are always advantageous as they produce a more even deposit and allow a greater current density to be used with a corresponding increase in the amount of work turned out in a given time.

Correspondence.

Good Effect of Boracic Acid in a Nickel Plating Solution.

Editor:

I was much interested in the article in THE BRASS WORLD, July 1911, page 234 on "The Effect of a Large Amount of Boracic Acid on a Nickel Plating Solution." The results reached will prove very instructive to men who still advocate a neutral or slightly acid solution. The superior quality of work which a solution containing a large amount of boracic acid will produce should be sufficiently convincing, particularly if the work is of such a character as to require buffing. The ease with which the nickel from a boracic acid solution may be buffed is quite apparent and takes place more readily than with a deposit from a neutral nickel plating solution. The production of a bright, clean deposit is a money saver in the buffing room.

In preparing iron or steel work for nickel plating, I recommend the use of a hydrofluoric acid dip composed of the following:

Water ..... 10 to 15 parts
Hydrofluoric Acid ... 1 part

The work to be plated is passed through this dip just before it enters the nickel solution, and all water-rust or oxidation will be removed. Rusty iron or steel is cleaned in a few seconds by means of this dip and there is no need of soaking in potash to loosen the rust. There will be no peeling of the nickel plated work, in fact, steel may be bent or twisted without the nickel deposit cracking or peeling.

I have used this acid as a cheap water dip for ten years and do not remember when I had a piece of work peel. Hardened springs or anything of this kind cannot be put into the dip as it will destroy the temper. It is not suitable for brass either, but for iron or steel it is much superior to sulphuric or muriatic acids.

James Hughes.

Gardner, Mass.
Aug. 21, 1911.

Specifications for Fuel-Oil.*

In consequence of the success that has attended the use of heating-value specifications in buying and selling coal there has arisen a demand for similar specifications, based on careful tests, to govern the purchase of fuel oils and the refined products of petroleum. The Bureau of Mines has therefore issued Technical Paper No. 3, on "Specifications for the purchase of fuel oil for the Government," with directions for sampling oil and natural gas. An extract from the introduction states:

These specifications, to be satisfactory, should establish not only the heating value of the oil, and thus show, like the specifications for coal, the number of heat units the purchaser obtains for a given price per unit quantity of fuel, but also the physical character of the oil, its flash point and burning point, and the quantity of extraneous matter it contains.

It is evident that an essential feature of any such plan of purchasing oil in bulk is an equitable method of sampling deliveries—that is, a method that insures the taking of representative samples.

The Bureau of Mines has received many inquiries from Government bureaus and from private concerns regarding fuel-oil specifications and the sampling of purchases. In reply to these inquiries the bureau issues this paper, which, although intended primarily for the guidance of Government officials, may be of service, the bureau trusts, to all persons who buy or sell fuel oil.

General specifications for the purchase of fuel oil are given as follows:

In determining the award of a contract, consideration will be given to the quality of the fuel offered by the bidders, as well as the price, and should it appear to be to the best interest of the Government to award a contract at a higher price than that named in the lowest bid or bids received, the contract will be so awarded.

Fuel oil should be either a natural homogeneous oil or a homogeneous residue from a natural oil; if the latter, all constituents having a low flash point should have been removed by distillation; it should not be composed of a light oil and a heavy residue mixed in such proportions as to give the density desired.

It should not have been distilled at a temperature high enough to burn it, nor at a temperature so high that flecks of carbonaceous matter began to separate.

It should not flash below 60° C. (140° F.) in a closed Abel-Pensky or Pensky-Martens tester.

Its specific gravity should range from 0.85 to 0.96 at 15° C. (59° F.); the oil should be rejected if its specific gravity is above 0.97 at that temperature.

It should be mobile, free from solid or semi-solid bodies, and should flow readily at ordinary atmospheric temperatures and under a head of 1 foot of oil, through a 4-inch pipe 10 feet in length.

It should not congeal nor become too sluggish to flow at 0° C. (32° F.).

It should have a calorific value of not less than 10,000 calories per gram (18,000 British thermal units per pound); 10,250 calories to be the standard. A bonus is to be paid or a penalty deducted, according to the method stated under section 21, as the fuel oil delivered is above or below this standard.

It should be rejected if it contains more than 2 per cent water.

It should be rejected if it contains more than 1 per cent sulphur.

It should not contain more than a trace of sand, clay, or dirt.

Each bidder must submit an accurate statement regarding the fuel oil he proposes to furnish. This statement should show: The commercial name of the oil; the name or designation of the field from which the oil is obtained; whether the oil is a crude oil, a refinery residue, or a distillate; the name and location of the refinery, if the oil has been refined at all.

The fuel oil is to be delivered f. o. b. cars or vessel, according to the manner of shipment, at such places, at such times, and in such quantities as may be required during the fiscal year ending————.

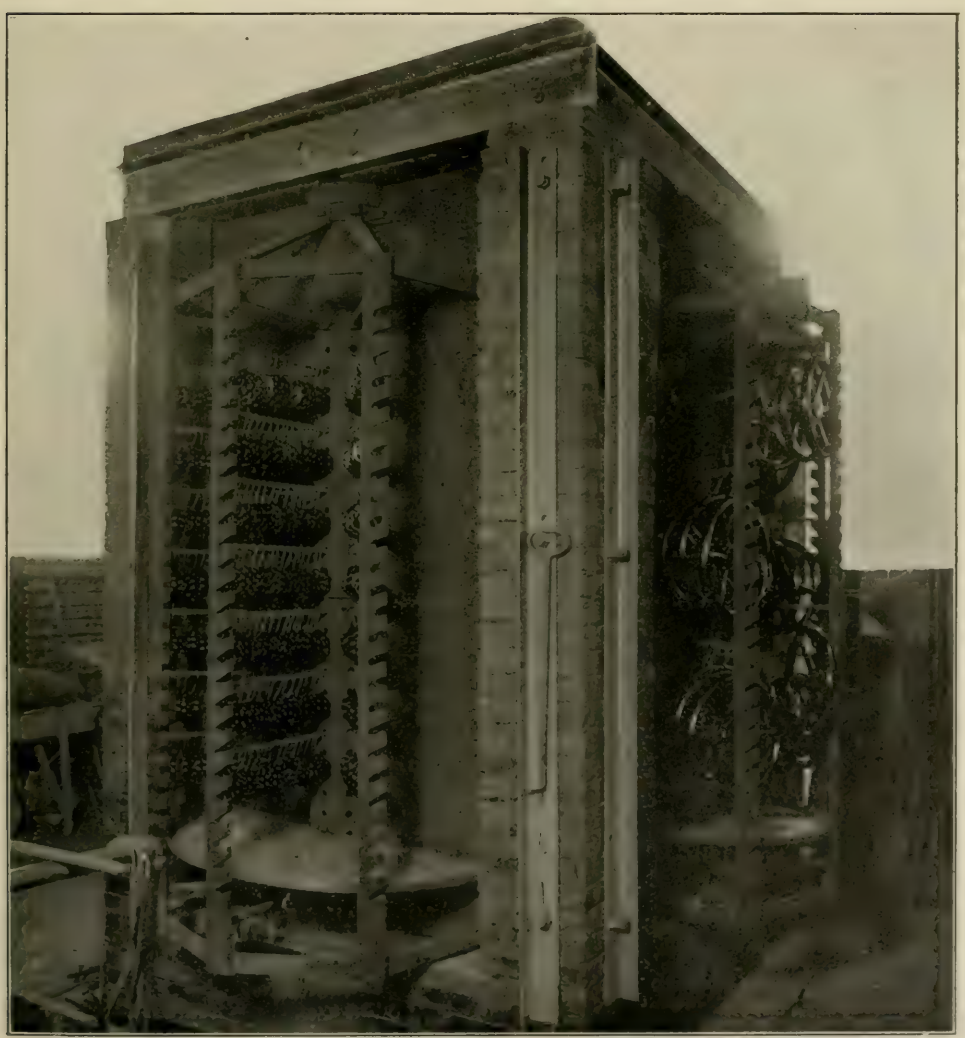
Should the contractor, for any reason, fail to comply with a written order to make delivery, the Government is to be at liberty to buy oil in open market and charge against the contractor any excess of price, above the contract price, of the fuel-oil so purchased.

*Announcement of the Bureau of Mines, Washington, D. C.

Japanning Oven for Nelson Valve Co.

A japanning oven for continuous operation without motive power other than manual was recently developed by Mr. Mason, Vice President and Manager of the Nelson Valve Co., in conjunction with Mr. George K. Hooper, of the Hooper-Falkenau Engineering Co., New York City. This oven consists of three reels mounted in a substantial brick casing; two of these reels may be seen in the accompanying illustrations. They are so located that one-half of each is always inside the oven, while the other half projects beyond the oven casing. Each is built up on a central pipe which is perforated to receive rods or bars which rest at the other end in slotted vertical outer ribs. Upon these bars are hung the articles to be japanned. The reel is divided vertically by a sheet metal diaphragm which serves to close the oven, confining one-half of the reel within the heated space.

To operate this oven, the articles dipped are hung upon the racks of that half of the reel which is outside the oven. The reel is then revolved a half turn, which moves the pieces into the heated space; at the same time the



Japanning Oven at the Plant of the Nelson Valve Co. Philadelphia, Pa.

other half of the reel containing the pieces which have been baked, is brought outside the oven. When the baked pieces are removed that half of the reel outside the oven is ready to be filled with freshly dipped pieces as previously described. This operation is continuous with a very low labor cost and a great elasticity because each type of piece to be baked can be kept in the oven its proper time without affecting the time for any other part.

A New Mixture for Manganese-Bronze.

A new mixture for manganese-bronze has been patented by Jesse Jones of the Westinghouse Electric & Mfg. Co. of Pittsburgh, Pa. (U. S. Patent 998,777, July 25, 1911). It is proposed to use a high-speed steel or a magnet steel in place of ordinary wrought iron in the manufacture of manganese bronze. Self hardening steel, he says, has approximately the following composition: Iron 80%; tungsten 18%; and chromium 2%. The magnet steel is usually composed of iron 95% and tungsten 5%.

To make the manganese-bronze with the steel, a "hardener" is first made. This is composed of the following:

Tin	30 parts
Ferro-Manganese	7½ parts
High Speed Steel	62½ parts

The steel and ferro manganese are melted together and then the tin added. In case the magnet steel is to be used, the same amount as that of the high speed steel is employed.

This "hardener" is then used with the other metals to make the manganese-bronze. The following proportions are given in the patent specification:

Copper	51 to 64 parts
Zinc	35 to 45 parts
Hardener	1/6 to 15 parts
Tin	1/6 to 3 parts
Aluminum	1/6 to 8 parts

The hardener and copper are melted in separate crucibles and then mixed. The other metals are then added.

Although tin has a low melting point, its boiling point is very high, much higher than that of copper, silver or gold.

Making a "Bright" Silver Plating Solution.

Bright silver plating solutions are now quite extensively used and probably the future will see them even more extensively employed. Their advantage lies in the fact that about three times as much silver can be deposited in a given time and scratch-brushing is rendered unnecessary. The scratch-brushing feature, however, is not of much importance compared with the rapidity of deposition of the silver, although, of course, it saves an operation, but the fact that the silver can be deposited three times faster than with the ordinary dead silver solution renders it possible to turn out three times as much work per day with a given tank in which the plating is carried out. In other words, the output of the plating room is increased without increasing the equipment. The only extra expense is the additional current density which means that a greater amount of current must be generated. This is comparatively an insignificant matter and there is usually no difficulty in producing this necessary supply with the ordinary equipment.

In the ordinary cyanide silver plating solution, made of chloride or cyanide of silver and potassium cyanide, the silver deposit is dead white and without lustre. The presence of a small quantity of sulphur in the solution, however, completely changes this dead deposit to a smooth and somewhat lustrous one, even after the deposition has been prolonged. Why the presence of this small quantity of sulphur should change the deposit is not clear, but it is known that an extremely small quantity only is required. It does not seem to matter in what manner the sulphur is added and there are various means of introducing it. Even the use of hard rubber racks (which contains sulphur) sooner or later introduces enough sulphur to cause a bright deposit to form. It is now thoroughly established that sulphur produces the bright deposit.

Although sulphur is the cause of the bright deposit, it has been found that, while it may be introduced by various means, *bi-sulphide of carbon* is the most satisfactory for the purpose and it is this substance that is employed for bringing about the bright silver deposit.

To add the bi-sulphide of carbon direct to the silver solution will not bring about the

desired results. It will settle down to the bottom of the tank and produce uneven and unsatisfactory work. In other words, it will not mix with the silver plating solution sufficiently to produce even results. The customary method of adding it is as follows:

Take a quart of silver plating solution and put 10 drops of bi-sulphide of carbon in it. The whole is placed in a corked bottle and shaken vigorously from time to time. Allow to stand over night to settle and then pour off the clean solution leaving the black residue. If any drops of the bi-sulphide of carbon remain, leave these in the bottom. The solution to be used should be clear. This is known as the "stock bi-sulphide of carbon" solution and is used for introducing the bi-sulphide of carbon into the regular silver plating solution.

To turn a regular silver plating solution over into a "bright" solution, add about 1 oz. of the "stock bi-sulphide of carbon" solution to each 10 gallons. The whole should be thoroughly mixed when it is ready for use. The deposit will then come bright.

When the silver deposit does not come wholly bright but is partly dead and partly white (or "patchy"), it indicates that the amount of bi-sulphide of carbon is not sufficient and more should be added (that is of the "stock" solution) in order to bring about the even and smooth surface of the "bright" silver solution. As the bi-sulphide becomes exhausted in the silver plating solution, it is necessary to add more of the "stock" solution from time to time. The need for this can easily be ascertained by the appearance of the silver deposit. Care must be exercised, however, in avoiding an excess as this will injure the deposit.

The silver deposit produced from a "bright" silver solution is smooth and has a slight lustre. It is considerably harder than a dead silver deposit, although burnishing may be done without difficulty. Bright silver deposits have proved so satisfactory in the manufacture of flat-ware, that many of the leading makers are now using them on their goods, and so far there have been no obstacles of a serious nature encountered. It has been stated that a bright silver deposit tarnishes more rapidly than a dead one (both, of which on the assumption that they have been burnished), but this has not yet been proved.

The Brass Foundry on the U. S. S. Georgia.

Repair shops on battleships have already been found very advantageous, even in times of peace as it enables the repairs to be made wherever the ship may happen to be, even though thousands of miles away from any location where the necessary work could be done on land. In the *Journal of the American Society of Naval Engineers* Lt. Commander Louis Shane of the U. S. Navy describes the repair shop on the battleship *Georgia*. The vessel is equipped with the necessary equipment for making nearly all kinds of repairs, but the description of the foundry is as follows:

Brass Foundry on the U. S. S. Georgia.

The foundry is situated on the upper deck and is in a small deck house abaft the after smoke pipe. It contains a Mircs combined blacksmith's forge and melting furnace capable of taking a No. 70 crucible, a bin with one-half a ton of Albany sand, several flasks, iron and wood, and other foundry accessories, such as tongs, shanks, clamps, etc. The largest casting made up to date weighed about 175 pounds with riser and gate. Since its original installation, in August, 1910, the foundry has turned out over 800 castings, all sizes. Among these are the castings for a speed lathe for the carpenter's shop, which include head and tail stocks, two tool posts, and two tool rests, a circular saw, cylinder heads for main circulating pump, blower engine and steam launch, cleats of all sizes, heads for oil strainers, distiller glands, eccentric straps for 100-k.w. dynamo engines, casting for arm of Blake pump, door for dynamo casing, crosshead for auxiliary condenser, 2-inch tees, brazing flanges for copper pipe, Lewis bolt-

socket plugs, flanged cross for steamer, pistons for dynamos, and many others.

Oil fuel is used for melting metal. There is a connection for a portable oil burner, which was made on board. Albany sand is used, as practically none but brass castings are made. Iron castings would be made in emergencies, but the crucibles, when melting iron, last only about three heats, while with brass they last for thirty heats. When at a navy yard, advantages are taken of the facilities of the yard foundry to make iron castings. The ship's molder does the work and the metal used is returned to the yard foundry in the form of pig stubbed out of store. Of iron castings so made, the tuyeres for the large double forge in the blacksmith's shop, castings for a rigging jack for making wire splices, saddles for gap lathe and dynamo pistons are examples.

Scrap metal is generally used to make castings. All brass, copper and other scrap metal is turned into the foundry by all departments. The red and yellow brasses are separated. The old zincs discarded from boilers are melted and used for making bronze or brass mixtures of known constituents. Babbitt metal is generally used instead of tin for making 88—10—2 mixture, as there is no tin on board. The small amount of antimony does not seem to affect the metal adversely.

All patterns are made in the carpenter's shop, and the circular saw and speed lathe, built by the ship's force, have made pattern making very much easier than formerly. There are no rated pattern makers on board, but the wood workers of the carpenter's gang manage to turn out very creditable patterns. Altogether the foundry has been a great asset to the repair plant of the ship, and much work that formerly was done by the Navy Yard is now done on board, on account of the fact that castings can be made on board.

A new method of treating water used in steam boilers is now being employed with excellent success in England. It consists in allowing the water to flow over an aluminum plate. It has been proved that boiler scale is almost entirely eliminated, even from hard waters, by the employment of the method. The aluminum plate is corrugated and used in as clean a condition as possible by frequent scrubbing.

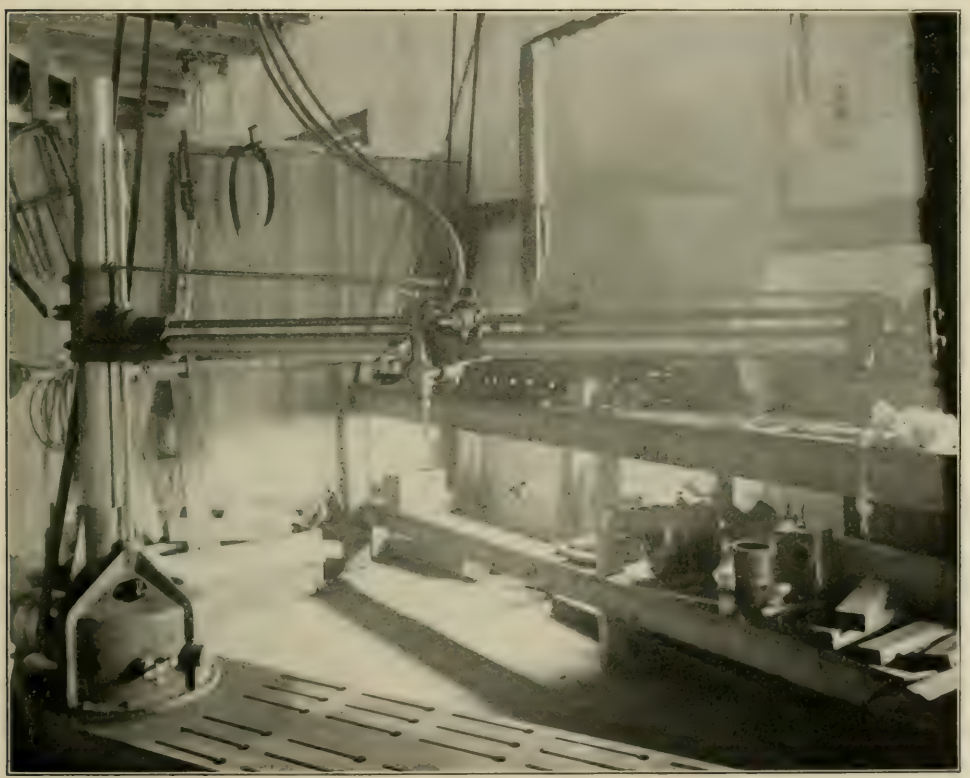
Acetylene Welding and Cutting Machine.

By J. F. Springer.

Hand welding and hand cutting are now familiar operations to which the acetylene blow-pipe is highly adapted. Where straight-line operations have to be carried out, especially in connection with repetition work, a machine is often applicable and advisable. Where sheets are very thin, machine welding is very desirable because of the certainty with which it can be regulated. The machine can be advantageously used in sheet metal work, where the thicknesses range up to, say, 3/16 or 7/32 inch. Straight cutting of both thin and thick work can be advantageously done with the machine because of the precision of the movement.

An acetylene welding and cutting machine has recently been built by the Davis-Bournonville Company of 90 West St., New York City, at their laboratory at Marion Station, Jersey City. The patent rights involved are held by this concern. There is a cylindrical upright perhaps six or seven feet in height. This carries a long hollow arm projecting for six or seven feet on one side. By means of a rack and pinion, this arm may be adjusted to any height desired. The arm carries a long screw, rotatably and horizontally mounted in suitable bearings. At the base of the upright, loose and tight pulleys are mounted on a short horizontal shaft and are driven from an ordinary countershaft above, which contacts with a suitable disk mounted on a vertical shaft. This latter shaft and a rotatable rod arranged in the hollow arm are put into driving connection by bevel gears. At the outer end of the arm, an arrangement of gears enables the inclosed rod to drive the screw. The turning of this screw operates a carriage back and forth horizontally along the arm. Upon the carriage, the torch and its controlling fixtures are mounted. The work is placed or secured on a suitable fixed table. Flexible tubes bring the oxygen and acetylene to the torch. The tip is practically the ordinary form. It is arranged at an angle, say of 40 or 45 degrees, to the horizontal, this angle being to the rear of the welding movement. The torch then moves over the work much after the way a cowcatcher passes along over a railway track.

The method of welding is often quite simple. Thus, if the weld is to be a flat one and of inconsiderable length, the two pieces are simply clamped in the exact relative positions they are to occupy finally. Room must, of course, be left for the tip to pass. The operation of welding is then not unlike that which occurs with an ordinary shaper. The carriage with the torch moves evenly along at the proper rate of speed. The countershaft, running at say 140 revolutions per minute operates the short horizontal shaft at about 70 revolutions. It is possible to adjust the friction pinion to vary the angular speed of the vertical shaft from about 70 to about 35 revolutions. Still further reductions of speed may be made by the gears at the end of the arm. Indeed, quite a range of speeds may be obtained by suitable combinations of the gears. The screw has about six threads to the inch, and gives the carriage a speed which may be varied from 3 to 24 inches per minute. The carriage has a back-and-forth range of five feet, five inches, which means that a weld of approximately that length may be made. If an angular weld is to be formed, the only difference to be made is in the arrangement of the work. The angle opens downwards and the vertical plane through the line of the weld bisects the dihedral angle. To illustrate by a practical example, we will suppose that it is desired to weld two strips edge to edge at an angle of 90 degrees. We place the strips on the sides of an angle bar, clamping them securely in position with clamping strips inserted between the outer faces of the work and the jaws of the clamps.



The Acetylene Welding and Cutting Machine.

There is a possible economy which is possible with hand welding, and which will probably come into pretty general use where the machine is used. The object of using an oxy-acetylene torch is for the purpose of getting a very high temperature. Because of the enormous temperature of about 6000 F.

which is claimed for the working point of the little inner flame, this torch is very successful in bringing steel and other metals locally to or near the melting point. Ordinary flames are incompetent to this. But the ordinary—and cheap—flame is competent to supply a large amount of the requisite heat. Where the form and character of the work do not prohibit, there seems no reason why pre-heating by cheap methods should not be employed. In other words, it is not necessary to do all the heating with gases like acetylene and oxygen. The saving is, however, not connected with the consumption of the gases alone. Time may also be saved; and this means economy of the labor and the machine. For example, certain work requiring a long seam and involving sheets 0.10 to 0.12 inch thick can be welded on a European machine at the rate of about 12 inches per minute. Practical experiments where the work was pre-heated before passing under the torch showed, so it is said, that the work—and I understand it to be the same class of work—can be welded at a speed of 26 to 28 inches per minute. The economy in time is striking. The methods of pre-heating may be various. Thus, if it is a question of small repetition work, the pre-heating may in some cases be done subsequent to clamping but prior to putting the work on the table. Other cases will require pre-heating with the work in welding position. In general, the pre-heating arrangements will not be difficult to provide. Pre-heating is to be recommended strongly for the two reasons —economy of oxygen consumption and reduction of effects of expansion and contraction.

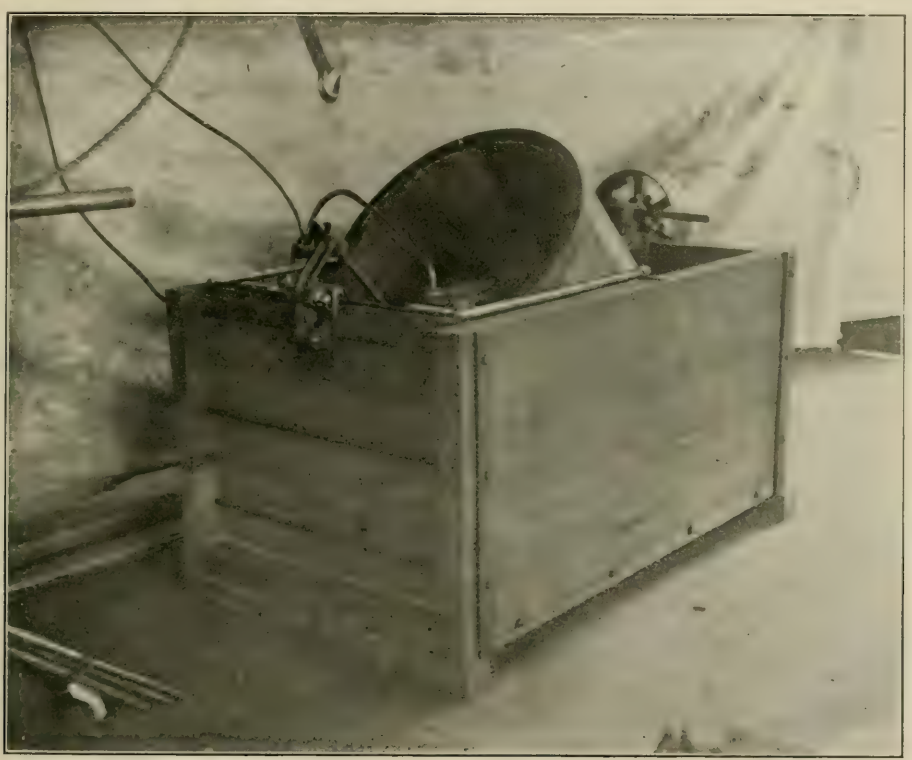
The machine already described as a welding device can readily be used as a cutting apparatus. The high precision of the motion of the carriage recommends it for this purpose. In cutting, however, some variations are made. In the first place, the jet arrangements are different. But this is perhaps more a matter of simultaneous development, as the new arrangement of jets will no doubt be effective as a hand tool. On the machine, three jets are arranged in a rigidly vertical position, the gases being driven directly downwards. These are arranged in line with the direction of movement. Ahead is a heating jet of oxygen and acetylene; at the rear is another but smaller heating jet. Between the two, the cutting jet of oxygen is arranged. Three flexible tubes bring the gases. An oxygen and an acetylene tube together supply the gases for the two heating jets. Thus these jets are both supplied from the same sources. An independent oxygen supply is provided for the cutting jet, for the reason that ordinarily the pressure back of this jet is higher—and sometimes, much higher—than is the case with the heating oxygen. By the foregoing arrangement of jets, a strong heat is provided just ahead of the cutting oxygen, and a moderate one just behind. The office of the jet ahead is pretty well known: it raises the steel to the temperature of combustion. The pure oxygen then enters the game, and the metal is "cut". It has been found, however, that by providing an auxiliary heater behind, the work of cutting is facilitated. Its operation is probably as follows: The forward jet provides heat for the metal which is probably somewhat lost by the time the pure oxygen jet comes along. This jet may be only three-eighths of an inch behind. Still it would seem that conduction would carry off considerable heat while the cutting jet is getting to the spot, especially where the movement is a slow one, as with very thick steel. The rear jet provides additional heat and thus reduces dissipation by conduction. Its scene of operation is in the region where much of the wasteful conduction would take place. In the case of thin plates, the rear jet is scarcely necessary and may be shut off. The whole arrangement is readily replaced and thus is permitted an economical adjustment to the size of the work.

It has been found unprofitable to use old tin cans in the process of detinning for recovering the tin. The cost of collecting, transportation and inability to dispose of the black iron plate are responsible for the cans not being utilized. This information was recently published by the United States Geological Survey which investigated the subject.

According to a Bulletin of the U. S. Geological Survey, domestic flake graphite is replacing to some extent the Ceylon graphite in the manufacture of graphite crucibles. It is stated that there is no reason why the domestic article cannot be even more extensively used as a grade similar to it has been used in Germany for some time in the manufacture of crucibles and with good results.

The "Wallace" Plating Barrel.

The new plating barrel herewith illustrated has been invented and patented by G. L. Wallace of the Harshaw, Fuller & Goodwin Company and is being placed on the market by the latter company. In devising the barrel, Mr. Wallace has departed from the usual path and has constructed a machine entirely different from anything heretofore made. It is believed that the good features of previous machines are embodied in it, and the objectionable ones have been eliminated.



The "Wallace" Plating Barrel. A Combination Oblique and Horizontal Barrel.

The barrel is a combination of the horizontal and oblique types of plating machines, and the advantages of both are obtained. The large quantity of plating solution used in a horizontal plating machine is obtained with all the features of the oblique barrel as regards constant inspection of the work, removal and anode surface.

The barrel itself is, it is believed, the largest made, and a corresponding quantity of work can be accommodated. The dimensions are 30 inches in diameter and 30 inches deep. The tank, in which it runs, is 30 x 30 x 56 inches.

The barrel is supported by two inclined rolls in the bottom of the tank and driven by a spur gear at the end. The barrel bottom is perforated and covered with cocoa-matting which has proved to be so serviceable for this class of work. The matting lasts many years.

Inside and outside anodes are used with the barrel and the inside anode, which is directly over the work, is so fastened that it may be swung out of the way when the barrel is removed.

The cathode connection is hinged to allow ready removal for hauling out the barrel by means of a suitable tackle arrangement not shown in the illustration.

The advantages of the barrel may be summed up as follows:

1. Presence of a large amount of plating solution so as to allow rapid deposition of metal without impoverishing it.

2. Inside and outside anodes so that the solution is properly fed with metal.

3. Work being plated is visible at all times

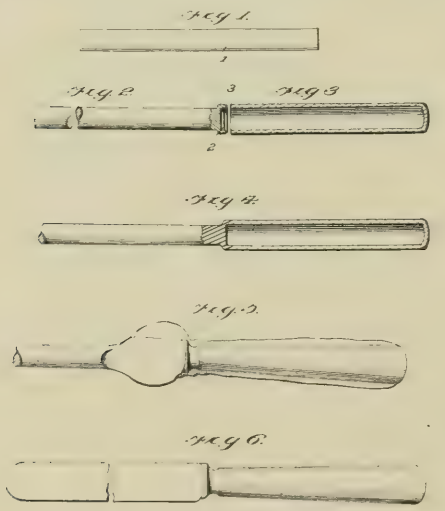
and the progress of the plating operation can be watched.

In addition to these features, of course, all the other advantages of a plating barrel are had. All kinds of work can be plated in the barrel and any kind of solution used. It is being placed on the market by the Harshaw, Fuller & Goodwin Co., 100 William St., New York City.

An Improvement in Making Hollow-Handle Knives.

An improved method of making hollow-handle knives has been patented by Hubert C. Hart of Unionville, Conn., the well known pioneer and manufacturer of this line of work. (U. S. Patent 999,557, Aug. 1, 1911).

When steel knives are made with a solid handle they are heavier than desired, and for this reason resort is had to the so-called hollow-handle. This handle is usually made in two pieces and soldered together, after



Method of Making the Hollow-Handle Knives.

which the whole is fastened to the blade. This method renders the operation costly and the joint is apt to show. The method employed by Hart is as follows:

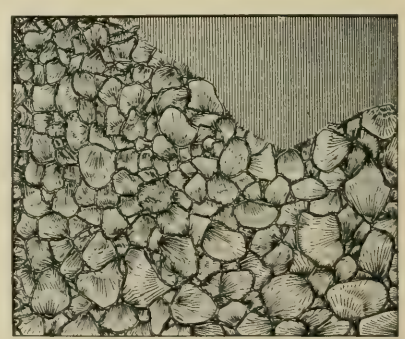
In carrying out the improved process, first provide a section of a round bar 1, indicated in Fig. 1, and then cup the end of the same as shown at 2. The cupped end is struck up to form a head, and its outer edge is beveled as at 3, to cause the metal more readily to weld in the subsequent welding operation. The tubular section is of uniform diameter throughout its length, and is of substantially the diameter of the head on the cupped end of the rod.

The beveled edge of the head of the rod is brought into contact with the end of the tube and is preferably subjected to the electric welding process to secure the ends together. The beveled edge being much thinner than the remaining wall of the cupped end it is more susceptible to the heat and therefore more effectually unites with the end of the tube thereby producing a cylindrical reduced blade end, and a tubular handle end as shown in Fig. 4.

After the rod and tube have been welded together, the form is then placed in a die and the handle and bolster of the knife are properly shaped, as shown in Fig. 5. This having been accomplished the rod is drawn out in a separate operation to complete the blade.

Use of Chinese Tung Oil for Ornamenting Metals.

Chinese or Japanese wood or tung oil has strong drying properties and in this respect it greatly surpasses linseed oil. A process for utilizing this strong drying quality in the ornamentation of metals has recently been patented by Joseph H. Glidden of Cleveland, Ohio.



The Finished Surface of the Sheet Metal.

The oil is applied to the metal surface and before drying is exposed to the fumes of nitric acid which cause the oil to coagulate and present the appearance indicated in the illustration herewith shown. Various effects may be produced by incorporating coloring matter, pigments or bronze powders with the oil before coagulating it with the nitric acid.

Some Interesting Information About Electrogalvanizing.

The following article is taken from an English publication and will prove of much interest to those who carry on electrogalvanizing and will serve to indicate some of the pitfalls and difficulties encountered in carrying out the process. The information was disclosed by the lawsuit being brought as will be noticed.

"Mr. Muir Mackenzie, High Court Official Referee, has continued the hearing of the action brought against the Northern Flexible Metallic Tube Co., of Bradford, by Wm. Canning & Co., of Birmingham, for 119*l.* 18*s.*, being four instalments of the purchase price of a plant for galvanizing steel strip. The defendants alleged that the plant was defective, and, charging the plaintiffs with breach of contract, presented a counterclaim *(The Ironmonger, June 24, p. 50)*.

Mr. William Earl Hughes, examiner in electrometallurgy for the City and Guilds of of London Institute, and electro chemist to the plaintiffs, said he remembered in 1908 the plaintiffs giving him samples of steel strip galvanized and black for testing. He had to test that which was galvanized in order to compare the amount of zinc on it with that he proposed to put on the black strip. The strip was bright and in very good condition. Witness had been asked to find out the least time required and the lowest current necessary to produce a deposit similar to that on the galvanized strip. He did so. Witness went to Bradford on February 8, 1911, and examined the plant generally, which was in a filthy condition. If the plant had been properly worked it could have properly treated the strip. So far as regards the chemical and electrical parts, and omitting the mechanical part, witness did not see why the plant could not be worked.

Cross-examined, he agreed that regularity of running and working induced efficiency. The electrolyte which he used was of the same density as that supplied to the defendants. Questioned concerning the various parts of the plant, the witness said that the object of the swill-box was to send out the strip free from everything except water. He did not know that the swill-boxes were lined with zinc. Speaking as a chemist, he would not call that a proper lining. He had not heard that the swill-boxes became eaten away and were returned in that condition to the plaintiffs.

Recalled on June 26 on behalf of the plaintiffs, Mr. G. A. Darby furnished further details as to the composition of various parts of the plant. He added that at the time of the installation he saw froth on the galvanizing tank. The bubbles of gas were quite usual and arose from electrical action.

In cross-examination by Mr. Waugh, K. C. (for the defendants) he denied that either he or any of his fellow employes took the felt wipers off the potash tank before the plant was left in the possession of the defendants. There was no wear that he observed upon any of the wipers before he left. While the pickle vat was at work, the iron was being subjected to the action of hyrdochloric acid. They were all surprised at the way in which the iron was eaten away. It would take a considerable time to replace it.

Further cross-examined, the witness said he had noticed froth on the top of the tank. There was a difference between froth and scum. Froth was clean, scum was dirty. He had made tests to ascertain the condition of the strip as it passed from one tank to another. In the absence of test paper he put his finger on the strip as it left the swill-box, and tasted it, and he should certainly have noticed any acid or potash if it had been there.

Mr. Hughes, recalled, gave evidence concerning various chemical experiments which he had made since the adjournment last week to show the action of chemicals on strip and felt. He thought, judging from experiments, that the solution was in good working condition; hence he was led to the conclusion that certain supposed causes of detriment were not operative.

In cross-examination, he did not agree with Mr. Waugh's suggestion that it was well known that for the purpose of obtaining a white deposit an acid solution, and not an alkaline solution, was the proper one. He admitted that a test successful in the laboratory was sometimes a failure when put into actual practice in the workshop.

Mr. Waugh, opening the defendants' case, said that the plaintiffs had never made a machine of this kind before. The defendants knew nothing about the construction of such an apparatus and relied on the plaintiffs' judgment. Regarding the plaintiffs' allegation

that if there were any faults in the plant the defendants' workmen were responsible. Counsel said that before the apparatus was delivered the defendants had worked a nickelling machine in a similar manner to the galvanising plant, and with marked success. Counsel denied that the defendants had accepted the machine as an experimental one. The plaintiffs did make experiments with it, but the defendants only accepted it on the understanding that it would do its work properly. He submitted that upon the evidence the plaintiffs themselves had given, it was obvious that the machine was not efficient.

Mr. Waugh said that the subject for which the machine was required was to put a sufficient coating of zinc on the strip to enable the strip to be manufactured into rust-proof flexible tubing. From the point of view of the scientist and the practical man, the machine was an absolute failure. From the time the defendants made up the strip into tubing and sent it out they had nothing but complaints, because the strip began to rust. Counsel intimated that he would call travellers who, in consequence of complaints from customers, inspected the goods on the premises of those customers, and they would say the complaints were justified.

It having transpired that the apparatus had been tested by the defendants last week, Mr. Terrell asked that his clients should have the opportunity of testing the machine at the defendants' works at Bradford.

After discussion, the Referee made an interim order that the plaintiffs should be at liberty to make the test on the following day (June 28) at their own expense, provided the plant was in the condition it was when the defendants tested it.

Mr. Albert Crowther, trading under the style of the defendant company, said the plant never produced salable strip. The strip came from the pickling tank too dark in colour. He informed the plaintiffs by letter that the plant would never answer until the iron and lead vats were replaced by slate vats, and the terminal winders were lined with wood. The defendant added that he knew of no other place where a plant designed like this one was working. Receiving no satisfaction, he declined to pay the balance of the contract price. During the four days Mr. Darby tested the apparatus he produced about one reel of the galvanized strip in short pieces. The complete load of the plant was six reels. Mr. Darby started with that number, but owing to the bad running of the machine they were constantly breaking. Since he had had this trouble in connection with the strip he had not been able to get the same orders as before. Some of his customers had ceased to deal with him altogether.

Mr. Sherard Cowper-Cowles, examined by Mr. Waugh, said he was the first to introduce electro-galvanizing commercially about twenty-five years ago. He examined the Bradford plant in September last year. The dynamo was too small for the work it had to do and the galvanizing tank was wrong mechanically. The wear and tear on the working parts were such that it was impossible to keep the plant going continuously. He thought that from an electrical point of view it was also wrong in construction. The anodes ought to be placed much closer on each side. The strip going in and out of the tank caused lamination: under a microscope several layers of metal could be seen on the rollers. He had made experiments in a similar direction twenty years ago, when he found that the strip was constantly breaking and the plant was impracticable, although a large sum of money was spent on it, and eventually it was scrapped. He was of opinion that a very long tank with a straight run was necessary. Another essential was even speed. In the Bradford plant the dynamo was a six-volt 250-ampere machine, whereas in order to run the strip at sufficient speed the power of the dynamo ought to be more like 1,000 or 1,500 amperes.

Mr. Waugh: As the result of your experience is it possible to get satisfactory results except you have your strip running horizontally through the electro-galvanizing plant?—No. Mr. Cowper-Coles, proceeding, said that regarding general design he did not think the Bradford machine could ever be got to work satisfactorily, and witness had had experience with a machine of similar design. He had also had a better winding-gear, and that, even, would not give satisfactory results. From a commercial point of view it was essential that there should be an even distribution of zinc all over the strip. He thought that with a machine as constructed it was impossible for an operator so to vary the current as to make current and speed synchronise. Speed was always varying and the current would have to be varied.

Mr. Cowper-Coles was still under cross-examination when counsel conferred, and subsequently Mr. Waugh asked the Referee to adjourn until June 30; in the meantime the defendant company would consider an offer made on behalf of the plaintiffs.

Mr. Terrell said that if they came to terms there was an end of the matter.

The "Nonesuch" Stop Carboy Rocker.

The emptying of acid from a carboy under the ordinary conditions found in a shop is not a satisfactory operation. Two men are usually necessary and if only one attempts to tip it over there is constant danger that the acid may be spilled. Many serious accidents have thus happened.

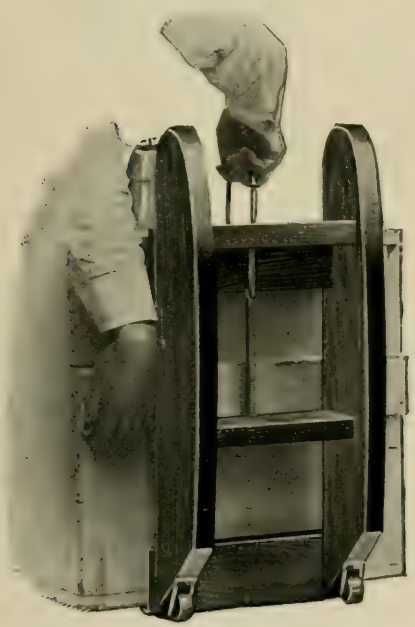


Fig. 1. Attaching Rocker to Carboy.

A stop carboy rocker called the "Nonesuch" has just been placed on the market by Rockhill & Victor, 114 John St., New York City. The rocker is herewith illustrated.

The rocker may be attached to the carboy in fifteen seconds and detached in the same time. One man can roll a full carboy to any desired position on the floor and completely empty it without spattering or spilling any of the acid. In use, the carboy can be left resting on the first or second stop and there is no need of placing it back. The directions for use are as follows:

Hold the rocker with the right hand by the curved, pointed, sliding hook, then with left hand take hold of the cleat on side of carboy

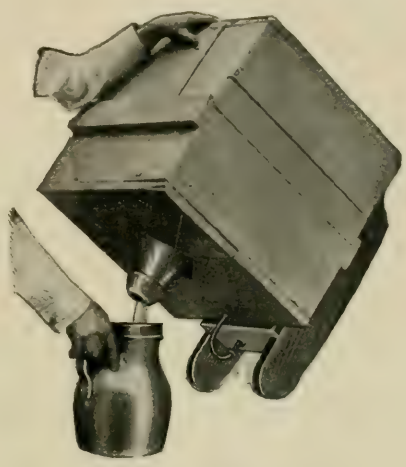


Fig. 2. Last Pitcher Full.

lift one side of carboy sufficient to catch the pointed supporting hooks underneath it and pull the curved sliding hook up and over, and press it down on top of the rocker. Then remove stopper of carboy and insert the vent tube closing the outer end of tube with the forefinger while inserting it.

The Production of Aluminum.

For several years France was the country producing aluminum, large mines of oxide of aluminum or bauxite, now turning out over 200,000 tons annually, having been opened in the Departments of Var, Bouches-du-Rhone, and Herault. The number of French aluminum factories has increased in the region of the Alps, especially in the Department of Savoie, where there are six establishments. With the two other French factories, it is estimated that the total output is considerably above 25,000 tons annually.

The reduction plant established in 1889 at Neuhausen in Switzerland has had a most successful existence. Starting with an annual

production of 40 tons of aluminum, it turned out no less than 2,621 tons in the first nine months of 1910, valued at more than $840,000. The company, some few years ago, established branches at Rheinfelden, in Germany, and Lend-Gastein, in Austria, and later opened another at Chippis, Canton Valais, Switzerland, all of which are operating successfully. The company is capitalized at $5,404,000, which it is proposed to increase to $6,021,600. Its stock has never yet paid less than 12 per cent; in 1906 it paid 26 per cent on a par value of 1,000 francs ($193).

The Swiss control of the aluminum market, which had existed for several years, passed away with the opening of the American factories at Niagara, for neither Switzerland nor France possesses such rich mines of oxide of aluminum and such sources of electrical energy as the United States. Negotiations were begun a year ago with the view of limiting the production of aluminum and keeping up the prices, but owing to the attitude of the American producers, the movement has not been successful up to this time.

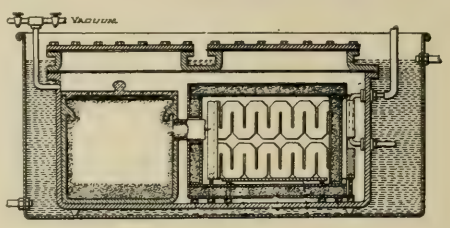
Aluminum has become indispensable in the construction of automobiles, dirigible balloons, and aeroplanes. It is employed also in paper decorations and for wrapping purposes. It has been found of enormous advantage also in the textile industry. Combined with silk, it makes a brilliant fabric, which can be given any desired color and which can not be excelled for making ceremonial costumes and theatrical wardrobes. In addition to the ordinary uses, it is also employed in the manufacture of reticules, scarfs, and various articles of use and ornament, and because of the high price of copper it has been largely used as a substitute for that metal in the manufacture of electrical cables.—*Daily Consular Report.*

The use of a large amount of boracic acid in a nickel plating solution has been found very advantageous. The nickel deposit is whiter and brighter than when a smaller amount is employed.

The pitting of a nickel deposit is very much lessened if the nickel plating solution contains a large amount of boracic acid. About 5 oz. of boracic acid to 1 gallon of nickel solution should be used for this purpose.

Separation of Gold and Silver by Distillation.

A novel method of separating gold and silver by distillation in a vacuum has recently been patented by W. C. Arsem, Schenectady, N. Y. The inventor found that silver distills over in a vacuum if a temperature be kept at about 1300° C., leaving the gold, platinum and other noble metals as the residue. If, when the silver has all been distilled over at



Apparatus for Distilling the Silver.

this temperature, the heat be raised to about 1500° C., the gold will distill over leaving the platinum and other high melting metals as a residue. In this manner it is possible to completely separate the metals.

The furnace used for the purpose is herewith illustrated. The outside of the furnace is made of a bronze casting and is lined with graphite grids for the heating elements through which an electric current is passed for producing the heat. The condensing chamber is either earthenware or iron in the form of a pot and cooled by means of water surrounding it. Several hours are required for the complete distillation of the silver. The crucible, in which the silver is melted is of graphite. Comparatively small quantities of metal are operated upon.

The "Thayer" Interval Timer.

A new device called an "Interval-Timer" has just been placed on the market and should find an entrance into the electroplating industry. The timer is not an alarm clock.

The appearance may be seen from the illustration. It can be set for any time from 1 to 5 hours or any fraction of an hour so that by setting, the expiration of the interval of time will be designated by the ringing of the bell.

In the electroplating industry this should be of value in determining the length of time a batch of work should remain in the tank.

Suppose, a lot of spoons are to be given a one hour silver deposit. The timer is set for one hour, and while the plating is going on, the plater need have no anxiety about the operation, nor is there any danger of the deposit running overtime. At the expiration of the hour, the bell rings, notifying the plater that the spoons should be taken from the tank.

The Interval Timer.

The timer is manufactured by the Edwards Mfg. Co. of Westfield, Mass., who have supplied it to many lines of trade where it has already proved of value.

A New Electrogalvanizing Solution.

A new electrogalvanizing solution has been patented by Edward F. Kern of New York City which, the inventor claims, is a marked improvement over other solutions now in use. The use of zinc chloride is claimed for the active zinc salt and an aluminum chloride is also introduced as a conducting salt. A small quantity of common salt is also employed in the solution and grape sugar is introduced for producing a smooth deposit.

The following proportions are given as a suitable bath:

Water	1 gallon
Zinc Chloride	1 lb.
Sodium Aluminum Chloride	5 oz.
Common Salt	4 oz.
Grape Sugar	5 oz.

The advantage claimed for the solution is that a very high current density may be used with a very low current voltage. With a current density of 20 amperes per sq. foot, the voltage was only 0.55 to 0.66 and a very dense, adherent deposit was obtained, wholly free from zinc salt or zinc oxide. In using the solution it was found advantageous to warm it to about 100° F. as the deposit was then better.

Welded Steel Plating Tanks.

The objection to cast-iron tanks is that they are heavy and in large sizes this causes a proportionate increase in cost. The development in oxy-acetylene welding has made it possible to produce a sheet steel tank as solid as a cast-iron one and without the danger of leaking that is apt to occur with a riveted one.

Appreciating the value of a welded steel tank, the Hanson & Van Winkle Co. of

A Welded Steel Tank.

Newark, N. J., have placed on the market a large number of sizes and which will be found of great service in the plating room. They can be used for holding cyanide solutions, electric cleaners, potash and soap solutions and hot water. The lightness of the tanks renders them comparatively inexpensive and easily handled. The welding produces an absolutely tight joint so that there is no danger of leakage.

It has frequently been supposed that vanadium ore workers are subject to "vanadium poisoning" like lead or arsenic ore workmen. An investigator has recently made a study of the matter and found that after five years of experience in smelting vanadium ores, no evidence of any ill effects directly attributable to vanadium could be discovered.

The "Baird" Spring Making Machines.

For many years the Baird Machine Company of Oakville, Conn., has built special spring making machines for those who use small springs in the making of their goods. Manufacturers of fire-arms, electrical goods, and metal goods generally all use springs in large quantities and a machine that will make the springs will prove of value to them.

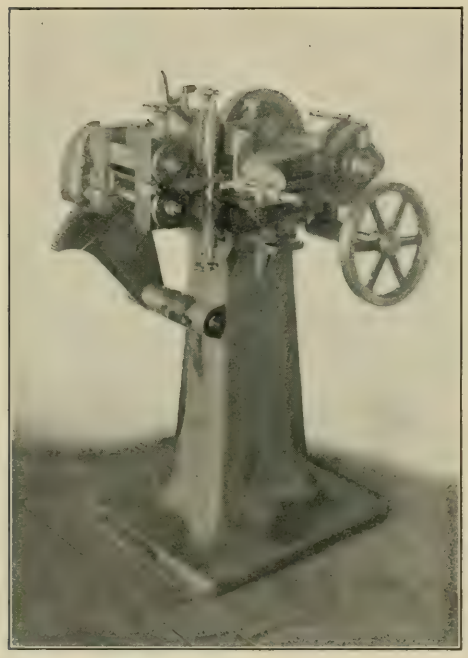


Fig. 1. "Baird" Spring Machine.

To meet the demand for spring making machines, a standard line of machines was made and which are now being placed on the market. These machines are divided into three types.

1. Spring Coiling and Cutting Machines.
2. Spring Winding and Cutting Machines.
3. Continuous Spring Coiling Machines.

The spring coiling and cutting machines are supplied with either die or roll tools to suit the case. Die tools are more readily changed, but the roll tools are better suited for jobbing manufacturers as with the same rolls and diameter of wire any spring within the capacity of the machine can be made.

The spring winding and cutting machine make springs on an entirely different principle from the coiling machines and open or closed, or right or left hand springs may be made. All have straight ends, but the ends may be varied to suit the case.

The continuous spring coiling machines are about the same as the spring coiling and cutting machines except that the springs are not cut off, but are made in continuous lengths. The machine may be used to make a spring so long that the whole length of the coil of wire will be used.

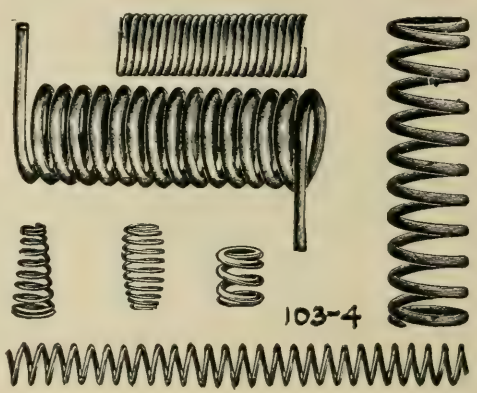


Fig. 2. Springs Made on the Machine.

In Fig. 1 is shown the Baird Spring Coiling and Cutting Machine for making the springs, either by means of the die or roll tools. In Fig. 2 is illustrated some springs made on it and showing the character.

An Improved Process of Precipitating Copper from Pickle, Waste Solutions Etc.

A California inventor has found that copper may be precipitated from solutions containing it, such as mine water, pickle or acid liquors, in a far more efficacious manner than heretofore possible by the following modification:

It is customary to pass the water containing the copper over scrap iron to precipitate it. The objection to this is that a large amount of iron is necessary and the copper is obtained in the form of copper slime which requires special treatment in smelting. In the

improved process coke is mixed with the scrap iron so that an electrolytic action is set up. The iron is almost entirely consumed and the copper is left on the coke. The coke is then smelted in a blast furnace and metallic copper produced.

Method of Precipitating the Copper.

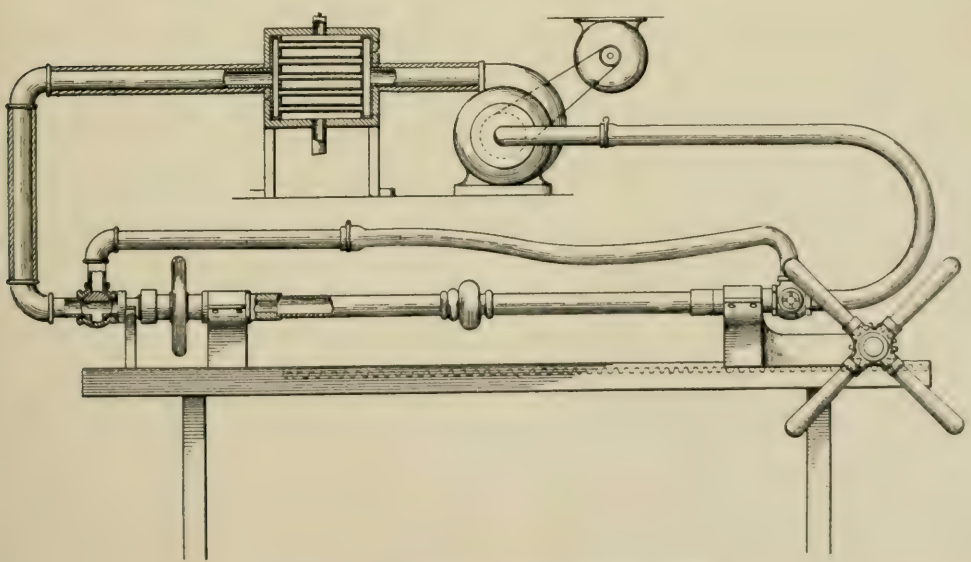
The illustration indicates the manner in which the coke and iron are mixed and the method of passing the solutions over them. Owing to the fact that very little basic copper salt forms, the length of the tank containing the iron and coke is much shorter than that usually required.

A Method of Heating Brass Tubing for Lacquering.

A method of heating brass tubing for lacquer has recently been patented by Joel L Isaacs of Red Bank, N. J. The process is applied to the lacquering of brass tubing to be used in the manufacture of brass bedsteads which, it is well known, must be heated while the lacquering is going on. It is customary in the lacquering of brass beds to use a spirit lacquer so that a heavy coat may be put on and when such a lacquer is employed the work must be warmed, otherwise one coat will take off the preceding one.

The present invention is in the manner of heating the tubing for lacquering. The tube is fastened, as shown in the illustration, in a sort of lathe between the centers so that it may be revolved. A pipe, heated by gas, steam, or electricity, connects with the tube to be lacquered so that a continuous stream of hot air is passed through it. The air is forced through by means of a small blower. By regulating the heat at the source of production, the temperature of the tube to be lacquered is readily controlled. The tube is revolved while the hot air is being passed through and the lacquering is done with a brush or spray. In this manner any number of coats may be applied as the drying takes place instantaneously and the previous coat is not removed.

A compound soft metal in the form of sheets is now being manufactured, consisting of britannia-metal on one side and a lead and antimony alloy on the other. This material is sold at a very much less price than a straight britannia-metal and may be used in place of it in many instances.



Apparatus for Lacquering Brass Bedstead Tubing.

Questions and Answers.

QUESTION No. 1029. What is the best method of polishing platinum?

Answer. Platinum has about the same hardness as hard brass and is best polished in the same manner. Cut down on a hard, cotton buff with tripoli and then finish on a soft rag buff with the finest gold rouge.

QUESTION No. 1031. Will you inform me what the trouble is with my silver solution used for silver deposit work? The deposit is smooth, but is very *brassy* and hard opposite the anodes and breaks when it is touched. The solution I have stands as follows:

Silver as Silver Cyanide ...	4.34 oz.
Free Cyanide	2.00 oz.
Temperature	85°
Density	4/5 volt

The brassy effect is only opposite the anode. Away from the anode, the deposit is soft and good.

Answr. From your description we should say that your current is too strong. You say you are using but 4/5 of a volt which is quite low, of course, and even much lower than is customarily used (about 1 volt is generally employed), but the deposit has all the indications of having been "burnt" by the use of too strong a current. We believe there is something wrong with your voltmeter. Either it is incorrect itself, or it is not placed correctly. We think if you investigate you will find this to be the case.

QUESTION No. 1032. We have been using Albany molding sand with satisfaction, but believing that a red sand, being much finer, would like some information about it. This red sand, we believe, is called "Windsor-Locks" sand. We tried in every way to make it work successfully, but we find that the castings made with it are scabbed when it is used as a facing, and when used alone it is too close and we cannot vent it. Can you furnish any information in regard to it?

Answer. Your difficulty lies in the manner of using the Windsor-Locks sand. It should be used as a facing for the mold and then the face of the mold *skin-dried.* The sand is so fine that it will produce scabs on the casting unless the skin drying process is carried out. All fine sands used for molding must be partially dried, at least before casting the metal in them in order to prevent scabbing. The Windsor Locks sand, unlike French sand, will not stand drying clear through but a partial drying, known as skin-drying, is used.

QUESTION No. 1034. What metal can be used for making rubber molds? In the manufacture of molded rubber goods, a soft metal mold is required, but we do not know what mixture to use.

Answer. The necessary quality in a rubber mold is to have it composed of some metal that is not attacked by the sulphur in the rubber. A tin base is excellent for this purpose, but pure tin is too soft. The following mixture, however, has been found quite satisfactory:

Tin	88 lbs.
Antimony	10 lbs.
Copper	2 lbs.

QUESTION No. 1035. Can tin ashes be reduced to metal by the use of a crucible? We accumulate a considerable quantity of this material but have nothing but a crucible furnace using oil. Could this kind of a furnace be employed?

Answer. You cannot use a crucible for this purpose. It is necessary to employ a reverberatory furnace designed especially for the reduction of tin drosses. This type of furnace takes a large quantity at a time, is heated by soft coal and is used particularly for the reduction of drosses. While a crucible could be used in a small way, it is neither economical nor satisfactory as a flux must be used and the life of the crucible is short on this account.

QUESTION No. 1036. Will the use of boracic acid in a nickel plating solution obviate the pitting of the deposit?

Answer. While boracic acid will not entirely overcome the pitting, it greatly reduces it. You will have to use a large amount, however, in order to obtain the full value. Use about 5 or 6 oz. of boracic acid to each gallon of the nickel solution.

QUESTION No. 1037. The firm for whom I work have an order for valve castings from 1 in. up to 5 in. These valves are to stand a water pressure of 3,000 lbs. per sq. in. The metal must also stand the following:

Tensile Strength	60,000 lbs. per sq. in.
Yield Point	30,000 lbs. per sq. in.
Elongation	15% in 2 inches

What mixture will stand the requirements?

Answer. You will have to use either manganese-bronze or aluminum-bronze (10%) in order to obtain the necessary tensile strength and yield point. The ordinary gun-metal, phosphor-bronze or brass mixtures will not give over about half of the necessary strength. You will have to have the patterns made sufficiently thick in order to prevent leakage under pressure. Manganese-bronze contains aluminum and anything containing this metal is difficult to cast so that it will not sweat under pressure.

QUESTION No. 1038. We are having some trouble with our nickel plating solution. The deposit cuts through very readily when buffed and if we leave it in the solution longer the nickel burns on the edges. Our dynamo is running 650 to 700 revolutions, but it is marked to run 800. Can you suggest any method for overcoming the light nickel deposit?

Answer. Your difficulty seems to be that

your solution is deficient in nickel. You will have to add some single nickel salts to supply the necessary quantity. Add 2 or 3 ounces of single nickel salts (nickel sulphate) to each gallon of solution and we believe you will have no further trouble unless it is with the burning. If this is the case, then you will have to cut down the current. The speed of the dynamo has no bearing on the matter as we do not know what current is generated The addition of the single salts is all that you need.

Question No. 1039. What method can be used for the reduction of babbitt-metal dross? We have on hand several tons of an aluminum babbitt-metal dross, which is a genuine babbitt-metal containing a small quantity of aluminum, and would like to know whether this can be reclaimed without a special furnace. Of what is this dross composed?

Answer. The dross is a mixture of metal and oxide of the metal and can be partially, but not wholly reclaimed without a special furnace. In treating soft metal drosses there are two operations carried out: First, the "sweating" of the dross for the removal of the metal in it. Second, the actual smelting of the oxide left after "sweating" in a reverberatory furnace. The "sweating" is readily accomplished but the smelting of the oxide requires a large, specially constructed and except those who make a business of it. To "sweat" the dross, heat it on a large iron pan with one end slightly inclined so that the metal will run off. Stir while being heated and the small metal shot will unite and run off the inclined end of the pan. When the mass has been stirred for some time, all the metal will have been reclaimed that it is possible to obtain and nothing but the oxide yill be left. This will have to be sold to dross refiners or smelters.

Question No. 1040. In an electrogalvanizing solution, what is the use of the sulphate of aluminum employed? I use a formula containing 4 oz. of sulphate of aluminum to 1 gallon of the sulphate of zinc solution (1 use 2 lbs. of sulphate of zinc in 1 gallon of water) and have been informed that the aluminum deposits with the zinc and renders it whiter.

Answer. The object of the aluminum sulphate is to render the zinc deposit smooth and brighter. The aluminum does *not* deposit. The action is not understood, but it is analagous to the action of dextrin or other organic substances in an acid copper solution. Without the sulphate of aluminum the zinc deposit is apt to be rough and dark colored, and for this reason, it is frequently called a "toner."

Question No. 1041. Are chills used in cast ing aluminum in sand with much success? I have never used them but hear that they are frequently employed.

Answer. Chills are quite successfully used in making aluminum sand castings and may frequently be used in place of risers. By placing a chill on a heavy portion that cannot yell be fed yith a riser, this portion is chilled and solidified without shrinking and the thin portions of the casting cannot draw from it. For chills, use rather thick pieces of smooth copper sheet. The heat conductivity of copper is so high that it answers the purpose admirably. The sheet should be clean and bright so as to avoid "blowing" when the aluminum strikes it.

Question No. 1042. We are endeavoring to find some method of blackening aluminum so that it can be used for army canteens, but without success. Is there any satisfactory method of blackening aluminum in the same manner that steel, copper, brass or other metals are blackened?

Answer. There is no method of blackening aluminum by the use of a solution or by plating that is satisfactory. The only method that is at all satisfactory is to first sand blast the aluminum and then apply a black lacquer. Special black lacquers are now made for applying to aluminum and are quite durable. They are extensively used for this purpose.

Question No. 1043. In making sterling-silver from shot copper and fine,granulated silver, which should be placed in the crucible first; or will it make no difference?

Answer. As copper melts at a higher temperature than silver and oxidizes readily, it should be placed in the bottom of the crucible and the silver on it. The object is to have the silver melt first and cover the copper as much as possible and thus protect it from oxidation. As a matter of fact, however, the copper and silver can be mixed, without apparent change in the quality of the sterling, but theoretically the best method is to place the copper in the bottom of the crucible.

Question No. 1045. In the use of Windsor-Locks sand for making brass castings, is it possible to use it for all classes of work, both bench and floor work? I am molding floor work and the castings are valves weighing several hundred pounds and would like to obtain as good a surface on the castings as possible.

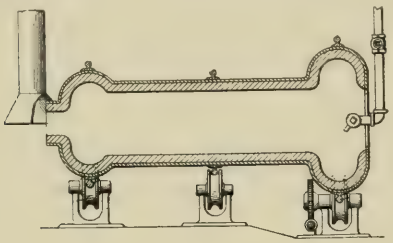
Answer. Windsor-Locks sand is too fine to be used on your castings. It is used principally for bench molding and occasionally for light floor work, but not for heavy castings. You cannot obtain as nice a surface on heavy castings as you can light work for the reason that the metal remains hot longer and thus attacks the sand and produces a rough skin. You should use a good facing for your work composed of part burnt sand and part new or all old sand if it has been used for some time. A medium grade of floor sand such as a No. 2 Albany will give you good results for the facing and if too rough castings are produced, mix with No. 1 sand. A coarser grade of sand say Albany No. 3 is better for floor work as it is more open.

Question No. 1048. Is mercury used for silvering glass mirrors at the present time?

Answer. The use of mercury for coating mirrors has now practically passed out of existence and silver has taken its place, both on account of being a cheaper operation and a healthy one.

Patent Abstracts.

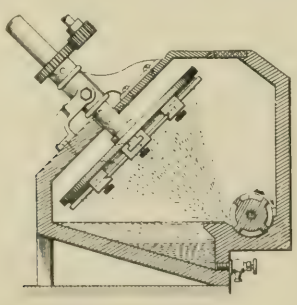
1,000,321, Aug. 8, 1911. ROTARY FURNACE. Irving L. Briggs of Clarksburg, W. Va. Assignor to Lillie Pearlman of Philadelphia, Pa. A rotary furnace for reducing and refining metals, such as the white metal



drosses. Gas or oil is used for the fuel and the advantage claimed is that the dross or ore to be smelted is constantly exposed to the flame action thus giving a quick and thorough treatment. The metal sweated out from the dross at first flows from the annular chamber from which it may be tapped out.

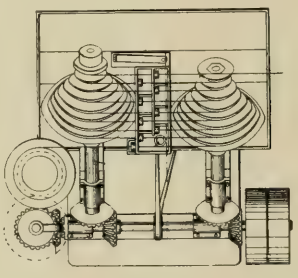
999,403, Aug. 1, 1911. WELDING COMPOUND. Robert N. Ruyle of Roodhouse, Ill. The welding compound, the inventor states, is suitable for welding steel, iron, copper, cast-iron and other metals. It consists of the following: Powdered clay 3 parts; Salt ¾ part; Carbonate of Iron ⅛ part; and Sal-Ammoniac ⅛ part. This compound is placed on the parts to be welded while at the welding heat.

1,001,031, Aug. 22, 1911. ETCHING APPARATUS. Beverly C. Hilliard of Philadelphia, Pa. An apparatus for rendering the etching of metal plates more rapid. The plate is held by clamps in a closed chamber and a



fan, driven by power, sprays the acid upon the face of the plate, thus rendering the operation quicker than when the etching is done in a still solution.

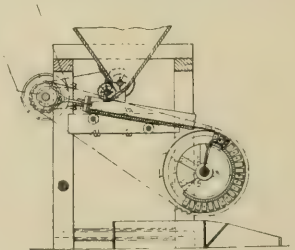
1,000,492, Aug. 15, 1911. WIRE DRAWING MACHINE. Elbert H. Carroll of Worcester, Mass. Assignor to the Morgan Construction Co. of the same city. An improvement in that class of wire drawing machines in which the wire is drawn through several successive dies in a continuous operation. The machine consists of a pair of conical



wire drawing capstans having straight sides from the bottom to the top with circumferential grooves. The opposite sides are substantially at an angle of 90 degrees to each other, and with the axes of the capstans inclined to bring the lower side vertical, thereby bringing all the grooves of this capstan at the front of the machine.

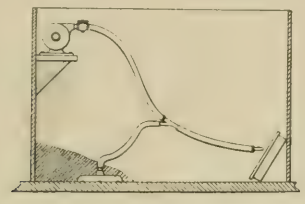
1,000,470, Aug. 15, 1911. RING MOLD. Frank C. Widman of Cleveland, Ohio. A mold for casting gold finger rings. The mold is made of iron and the construction of it is the essential feature of the patent.

1,000,392, Aug. 15, 1911. MAGNETIC SEPARATOR. Eugene J. Feeley of Fairfield, Conn. A magnet machine for separating iron from brass chips etc. The machine has been simplified so as to render the operation more rapid and reduce the wear and tear



on it. The use of a commutator is avoided and the danger of short circuiting due to wear on the insulation is thus avoided. Inspection of the drawings of the patent specification will indicate the manner in which this is accomplished.

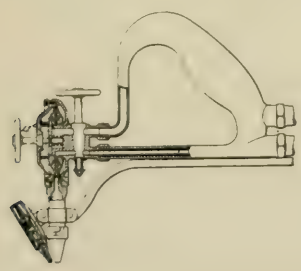
999,485, Aug. 1, 1911. APPARATUS FOR CLEANING CASTINGS AND THE LIKE. Charles W. Carolin of Detroit, Mich. Assignor to the Eenterprise Foundry Co., of Detroit, Mich. A sand-blast for use in cleaning castings. The apparatus is so designed that the



sand is sucked up from the position in which settles after coming from the casting, and is used over again. This suction device is the essential feature of the patent. The re-handling of the sand is thus avoided.

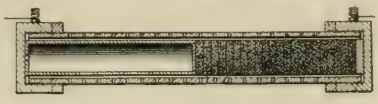
999146, July 25, 1911. FOB-CHAIN, BRACELET AND METHOD OF MAKING SAME. George H. Berthold of Attleboro, Mass. Assignor to the Metallic Company of the same place. The method of making links for chains, bracelets etc. Sheet metal, having a number of raised portions, is formed representing the beads of a bead chain, cutting away the opposite edges to form the projecting ears for the pivot bearings and notches between same. These blanks are assembled side by side.

1,000,018, Aug. 8, 1911. BURNER FOR CUTTING METAL OR FOR AUTOGENOUS WELDING. Heinrich Knapp of Weimar, Germany. An improvement in a burner used in oxy-acetylene welding and cutting. This invention is so constructed that



the passage of oxygen into the mixing chamber is accompanied by an injector-like feeding action of the gas, whereby independence of the particular level of the gas holder is secured and the use of pressure regulators avoided.

1,000,146, TEMPERATURE COMPENSATING DEVICE. William H. Bristol of Waterbury, Conn. The invention relates to a temperature compensating device particularly adapted to sensitive electrical instruments and



electrical temperature measuring devices whose indications are affected by small variations of temperature of the medium in which they are placed.

1,001,381, Aug. 22, 1911. BLACKING OR DRESSING FOR METAL SURFACES. Duncan R. Franklin of New York City. Assignor to S. M. Bixby & Co., of New York City. A blacking or dressing for metal surfaces, particularly for stoves, consisting of an emulsion of cobalt hydrate and graphite. The heat to which the metal is subjected decomposes the cobalt hydrate with formation of a black cobalt oxide and a hard substance. The material is particularly suitable for filling cracks and holes.

999,491, Aug. 1, 1911. METAL POLISH. Carleton Ellis of Larchmont, N. Y. Assignor to the Ellis-Foster Company. A non-inflammable brass polish. The following mixture is employed: Gasoline 80 parts; carbon tetrachloride 10 parts; nitrobenzol 6 parts; wood turpentine 4 parts; and ground silex 30 parts. The carbon tetrachloride is added to render the whole non-inflammable.

1,000,037, ELECTROPLATED WOODEN BODY AND SIMILAR POROUS ARTICLE. Joseph H. Pryor of New York City. A method of plating wood for use in bath rooms etc. The wood is treated in a bath of wax so as to fill the pores, after which it is coated with graphite and then electroplated.

999,438, Aug. 1, 1911. NAME PLATE. Albert Sylvanus Eberman and Enoch Harlan of Baltimore, Md. A thin sheet of metal is coated with solder and the short shank

portion of a linotype slug is then applied, after which the solder is melted. The back of the linotype slug is then planed off leaving the impression end on the plate.

Trade Items.

The Harris Typewriter Company has been organized in Fond du Lac, Wis., with a capital stock of $350,000. A factory has been purchased in that place and is being equipped for manufacturing.

The Kurtz Brass Bed Co., of Corry, Pa., manufacturers of brass beds, is to build a new plant, 100 x 250 feet, of brick and concrete construction. The plant will be located on the Erie R. R. The power will be supplied by a gas engine.

Albert & J. M. Anderson Mfg. Co., 289 A St. Boston, Mass., manufacturers of electric railway, light and power specialties are to install a hot galvanizing plant at their works in that city for galvanizing the malleable iron castings used in the manufacture of their goods.

Walter Dow, formerly superintendent of the Dow Chemical Mfg. Co., of Mansfield, Ohio, has purchased the polishing and buffing supply end of the business from that company and will continue the manufacture of a full line of these supplies under the same formulas used by them. All orders held by that company, he states, will be filled at once.

The Bohl Process Casting Company has been incorporated in New York City with a capital stock of $30,000 to establish a foundry and carry on the Bohl process for casting metals, such as brass, bronze, silver and gold in plaster of Paris molds. This process was patented by Ernest L. Bohl some time ago. The incorporators are Ernest L. Bohl, Robert Y. Barrows, and Charles H. Howard. The present foundry is at 550 West 25th St., New York City.

The Mueller Mfg. Co., of Decatur, Ill., the largest manufacturers of plumbers' brass goods in the United States, as well as one of the oldest, have decided to build a branch plant in Canada and a site will be selected in some advantageous city in that country. The new plant is to cost $200,000 and 150 men will be employed. A brass foundry and plating plant will be established. W. N. Dill, the representative of the company on the Pacific Coast is to have charge of the plant.

The Brown Instrument Co., 311 Walnut St., Philadelphia, Pa., the first company in the United States to manufacture pyrometers, having been located in that city since 1860, have been forced to move to larger quarters on account of the great increase of their business. It has more than quadrupled in the past five years. With this end in view the shops will be combined with the Keystone Electrical Instrument Co., of Philadelphia, Pa., of which Richard P. Brown is president. This factory is at 9th St., and Montgomery Ave., and the office at 311 Walnut St., will be still maintained. The consolidation with the Keystone company will give them improved facilities for making their goods.

The Muncie Brass & Aluminum Foundry recently organized in Muncie, Ind., to make brass, bronze and aluminum castings, have taken a portion of the iron foundry occupied by Patrick Murphy.

The Abbott Ball Co., 14 Hicks St., Hartford, Conn., manufacturers of steel balls for tumbling metals in order to burnish them, and also makers of tumbling barrels for the tumbling, have purchased a site in Elmwood, a suburb of Hartford, Conn., and will erect a new factory on it. This factory is to be 40 x 100 feet.

The plant of the American Cash Register Company is to be moved from Columbus, Ohio to Detroit, Mich. where it will be merged with the Michigan Cash Register Company. Hugh Chalmers of the Chalmers Motor Company of Detroit, Mich., is to be president of the new company. A site has been secured and a plant will be built.

The Hillen Mfg. Co., has been organized in Louisville, Ky., to manufacture plumbers' brass goods and have located at 308 East Green St., in that city. A brass foundry is being equipped and a general line of brass work will be made. George F. Hillen, formerly superintendent of the brass department of the Standard Sanitary Mfg. Co., is the organizer of the company.

The Bates & Peard Annealing Furnace Co., of Hutton, Liverpool, England, have appointed Hartley, Spalckhaver and Fay, 296 Broadway, New York City as selling agents in the United States for their annealing furnaces. This firm takes over the business of the late C. M. Dally, who acted as agent for a number of years. The furnaces, as well known, anneal metals without oxidation.

The Routh Solder Company has been formed at 10 Hobson St., Newark, N. J., to manufacture a new tinner's solder. It is cheaper than ordinary tinner's solder and contains only new materials. The object is to supply a solder melting and flowing as well as ordinary solder, but still be cheaper. The company claims that from 30 to 35 per cent of the solder bills of any manufacturing or tinning concern can be saved by using the solder.

The Bontempi Rust-Proofing Company, who have been located in New York City for some time, are installing a plant in Bridgeport, Conn., at 353-357 Water St., and which will be ready within a short time. The process of the company is applied to the rust-proofing of iron and steel and the new plant will be conducted as a jobbing establishment for the trade. The office of the company is at 111 Broadway, New York City and information will always be supplied about the process and its application. Samples will be sent upon request and those who are looking for a black and rust proof finish should communicate with them.

Barnet Wiener, manufacturer of antique copper and brass goods at 224 Center St., New York City, has gone into bankruptcy.

The Elgin Silver Plate Company of Elgin, Ill., manufacturers of coffin hardware, have incorporated their company with a capital stock of $100,000.

The Jackson Ornamental Iron & Bronze Works has been incorporated in Jackson, Tenn., and will build a plant at a cost of $25,000. Iron, steel, bronze and brass ornamental work will be manufactured. W. M. Burns is the superintendent.

The New Era Mfg. Co., of Kalamazoo, Mich., have placed on the market a new flux for use in the brass foundry. It is called "Meta-loyed-flux" and is used for all kinds of scrap metals as well as copper, brass, bronze and aluminum.

A new office building is to be built by the Balbach Smelting & Refining Company of Newark, N. J., copper smelters and refiners. This will be built at 578 Market St., and is to cost $25,000. It will be of brick and concrete, three stories high and the chemical laboratory will be situated in it.

The United States Steel Co., have issued an order in regard to the smoking of tobacco in their plants. Hereafter smoking will not be allowed, but the chewing of tobacco will be permitted in the brass departments of the individual plants as the management believes that it partially prevents the poisonous action of the brass upon the workmen.

The Platnide Company, Melrose Highlands, Mass., are now manufacturing a new alloy called "Platnide" which they claim is the nearest approach to metallic platinum known. It is supplied in the form of sheet, wire, rod and tubing and is now being used in the manufacture of jewelry, art metal work and similar lines of goods where a white and non-corrosive metal is desired.

Recent returns to the State of Wisconsin in connection with the new Wisconsin Compensation Act, show that the Chicago Brass Company at Kenosha, Wis., manufacturers of sheet brass, rod, wire and tubing are employing 712 hands. The Die Molded Casting Company of Milwaukee, manufacturers of die castings, employ 60 hands, and the Badger Brass Co., of Kenosha, manufacturers of automobile lamps and similar goods, employ 550 hands.

The plant of the Art Brass & Fixture Mfg. Co., of Pittsburgh, Pa., has been formerly opened. The company was recently incorporated with a capital stock of $100,000 to manufacture gas and electric fixtures and a similar line of brass and metal goods. The main office and plant of the company are at McKees Rocks, Pa., near Pittsburgh. The officers of the company are: President, Lawrence M. Fluhart; vice-president, Scott Hayes; treasurer, Livingston R. Jeffords; secretary, John A. Irwin; counsel, Carrol P. Davis; general sales manager, Earl B. Hennecker.

The Illinois Smelting & Refining Company, 410 North Peoria St., Chicago, Ill., is to build an addition to their plant for the purpose of manufacturing blue-vitriol.

Thomas A. Ashton of Sheffield, England is now acting as agent for the blowers and sand-blasts manufactured by Leiman Bros., 62 John St., New York City.

The Shoe Hardware Company, Waterbury, Conn., manufacturers of buckles and aluminum castings, are to erect a five story addition to their works and which will be 86 x 96 feet.

Plans are being prepared for the erection of a new factory for the Crown Metal Furniture Company at Jamestown, N. Y. This will be located in East Jamestown on the Erie R. R. and the main factory is to be 400 feet in length.

The Munning-Loeb Company, Matawan, N. J., manufacture the "Optimus" plater which is something new in the generator line. These new platers are now ready for delivery and the Munning-Loeb Company would like to tell about it.

The Standard Machinery Co., of Providence, R. I., manufacturers of metal working machinery, have just issued a new and extensive catalogue of 131 pages describing the large line of presses that they manufacture. This line comprises single and double acting power presses, and also transfer, reducing, coining and double crank presses.

John C. Wiarda & Company, 261 Green St., Brooklyn, N. Y., manufacture all kinds of anodes for the plating trade, nickel salts, copper carbonate, red copper compound, zinc carbonate and sulphate and all other chemicals used. They sell lye, tanks, hydrofluoric acid, tripoli, etc. Platers and manufacturers should obtain prices from them as they are prepared to quote very attractive prices.

The gold and silver scale made by Herman Kohlbusch, Sr., 170 Broadway, New York City, is used for estimating the amount of gold or silver being deposited on flat-ware and other goods. The scale is used while the plating is being done, so that when the right amount of silver or gold has been deposited, the weight of it pulls the beam down and rings a bell, notifying the plater that the right quantity of metal has been deposited. This scale is used in nearly all of the flat-ware shops.

The Buffalo Copper and Brass Rolling Mill, Buffalo, N. Y., are manufacturers of sheet copper of all kinds, copper anodes of pure Lake copper, brass in sheets, rods and wire and brazed brass and copper tubing. The quality is of the very highest and they solicit an opportunity to quote upon any of these materials. Their mill is one of the most modern in the United States and only the most skilled workmen are employed. The New England Office is at 141 Milk St., Boston, Mass., from which all of the Eastern trade will be handled.

The new plant of Lawrence Bros., Sterling, Ill., manufacturers of builders' hardware, is rapidly nearing completion.

The Alliance Brass & Bronze Co., of Alliance, Ohio has let the contract for a new brass foundry 40 x 100 feet.

The Copeman Electric Stove Company has been organized in Flint, Mich., with a capital stock of $500,000 to manufacture an electric heater.

The plant of the Electrolytic Art Metal Co., of Trenton, N. J., manufacturers of silver deposit wares, has been moved to Beatty and Adeline Sts., in that city.

The Regal Silver Company, Bradley and William Sts., New Haven, Conn., are installing drop hammers for the manufacture of table cutlery. Plated ware is also manufactured.

A plant will be built by the Breed Mfg. Co., at Bay City, Mich., for the manufacture of motor-cycles. A site has been secured in that city. This company is now located in Detroit, Mich.

Albert A. Moers, 24-26 Stone St., New York City, the well known metal dealer, is sending out to the trade an illustrated blotter with the inscription: "Buy Tin from the Agent Independent of Any Syndicate."

The Hahn Brass Company of New Hamburg, Ont. Canada are now running their plant by electricity, the current for which is obtained by the system of the Hydroelectric Commission.

The Hanson & Van Winkle Co., 269 Oliver St., Newark, N. J., the extensive manufacturers of plating supplies and equipment are sending out to the trade their Bulletin No. 105 describing the low voltage dynamos which they manufacture. This is a Bulletin of 40 pages and in addition to the dynamos, a list of accessories and equipment, such as rheostats, voltmeters, ammeters etc. are described. The Bulletin will be sent to those who desire it.

The Electric Smelting & Aluminum Company, Lockport, N. Y., have recently issued a new booklet on their "Mineral Cleaner" which will prove of much interest to those who carry on electroplating or the finishing of metals. The booklet gives the method of using the cleaner and the theory of it. Testimonials are likewise printed in it. This booklet will be sent to anyone interested, and all platers should write for a copy as it will prove of value to them.

The Acorn Brass Mfg. Co., of Chicago, Ill., manufacturers of a large line of brass goods, moved on Sept. 1st, to their new factory and offices in Aurora, Ill., where exceptional facilities for manufacturing are had. Their former factory had but 2,000 sq. feet of floor space, while they have 60,000 sq. feet in their new plant. Exceptional transportation facilities are possessed by the proximity of five different railroads and four express companies.

The Bingham Mfg. Co., 227 Prospect St., Cleveland, Ohio is contemplating the erection of a plant for the manufacture of bronze carbureters.

The Adjustable Shade Holder Co., has been organized in Bedford, Ind., with a capital stock of $10,000 to manufacture lamp accessories.

An interest in the Metallic Art Co., 125 Railroad Ave., Newark, N. J., has been purchased by Richard F. Faux and he will take charge of the factory. German-silver toilet articles are made by this company.

Acid users should investigate the new "Nonesuch" carboy rocker made by Rockhill & Victor, 114 John St., New York City. This rocker renders the emptying of acid a pleasure.

The Keystone Bronze Co., New Brighton, Pa., are to build a new addition to their works in that city. A brass foundry 32 x 50 feet is to be built in which oil furnaces are to be installed.

Temporary quarters have been opened by the Standard Brass Foundry Company on Columbus Road, Cleveland, Ohio. A new brass foundry for the manufacture of brass, bronze and aluminum castings is to be built when a site has been obtained. The capital stock of the company is now $100,000, having been increased from $50,000.

The Oxy-Carbi Company, 516 Orchard St., New Haven, Conn., are sending out a circular to the trade announcing that they are prepared to weld all kinds of metals by the oxy-acetylene process. They will repair bronze statuary, stove parts, steel tanks, weld brass, copper and aluminum in all forms, either sheet or castings.

The Spottiswoode Varnish Company, 619 Union Building, Newark, N. J., manufactures lacquers for use on metal goods that are of the highest character. Their lacquers are of guaranteed quality so that consumers need have no hesitation in placing a trial order with them. Lacquer users should write for samples and prices. The works of the company are at 469 New Jersey R. R. Ave., Newark, N. J.

The Harral Soap Company, 465 Greenwich St., New York City, started in business years ago for the purpose of making high-grade soap specialties. They met with such success that they decided to enter the manufacture of metal soaps. The result is the placing on the market of a number of high grade soaps that have met with the approval of trade. They manufacture burnishing compound for tumbling metal goods, fig cleanser for cleaning buffing dirt and rouge from metals, "Klean-Easy" for removing Vienna-lime from polished surfaces, "Coco-Tallow" chips for blanking and drawing metals and soft castile compound for wire drawing. Samples will be submitted on request and platers should write to them for information which will be gladly supplied.

H. J. Geer, manufacturer of jewelry novelties, has moved his factory from 9 Calender St., to 11 Snow St., in Providence, R. I.

The Eclipse Gas Stove Co., of Rockford, Ill., are to erect a new addition to their factory, and which will be 70 x 80 feet.

The Lafayette Safe & Lock Co., Lafayette, Ind. is about to make an addition to its plant in that city. It is expected that it will be in operation in about two months.

The Union Cutlery Company of Tidioute, Pa., are to move their cutlery manufacturing plant to Olean, N. Y., where it is said that 100 hands will be employed.

W. F. Quarters, the well known electroplater and colorer of Providence, R. I., has removed his business to 14 Blount St., in that city where increased facilities are had for carrying on his work.

The Rex Manufacturing Company has been organized in Providence, R. I., for the manufacture of jewelry, such as fobs, bracelets and chains. They have commenced manufacturing at 14 Blount St., in that city.

The large addition to the plant of L. C. Smith & Bros., Syracuse, N. Y., manufacturers of typewriters, is progressing and it is expected that it will be completed before the first of the year. When finished and equipped with machinery, the capacity of the plant will be doubled.

The Bay View Foundry Company of Sandusky, Ohio, manufacturers of iron and brass castings and patterns, have increased their plant by the addition of a pattern shop. The well known pattern expert, A. G. T. Smith, has been retained by the company and will take charge of this department.

The Aluminum Foundry Company, recently incorporated in Sebring, Ohio, to manufacture aluminum castings and other aluminum goods, have let the contract for the erection of their new plant. It will consist of a brick foundry building, 50 x 150 feet. The company will make aluminum castings for the jobbing trade and aluminum cooping utensils.

The Davis-Bournonville Company, 90 West St., New York City and 515 Laflin St., Chicago, Ill., are sending out to the trade their August edition of "Autogenous Welding" in which is contained some extensive and valuable information in regard to oxy-acetylene welding. This pamphlet will be sent gratuitously to those who are interested.

A new company has been formed by G. D Jenison, foreman plater and chemist of the Faries Mfg. Co. of Decatur, Ill., for the manufacture of a solution for producing a gunmetal finish on brass work such as automobile work etc. It is claimed that this finish will not peel or crack and is a black that is very durable. The new company is called the Gun Metal Finish Company and the material will be handled by the Beckley-Ralston Company of Chicago, Ill., dealers in automobile supplies.

The factory of the Charles A. Bennett Silver Company at Taunton, Mass., manufacturers of silver plated hollow-ware, was damaged by fire on August 21st. to a considerable extent. It is supposed that the fire was caused by spontaneous combustion.

The Dake Engine Company of Grand Haven, Mich. has recently increased its brass foundry department and is now prepared to make brass and bronze castings for the jobbing trade up to 5 tons in weight. Large iron castings are also made and the iron foundry has likewise been increased in size.

The business of the Precision Die Casting Company of Syracuse, N. Y., manufacturers of die castings has been taken over by a new company called the Holmes & Morris Mfg Co., recently organized for this purpose. F. R. Holmes is the owner of the Precision Die Casting Co. The location of the company is at 402 South Franklin St.

The Nashville Adding Machine Company, recently incorporated in Nashville, Tenn., to manufacture an adding machine, has taken the factory formerly occupied by the Hinds Shoe Company in that city and manufacturing will be commenced as soon as possible. The adding machine is the invention of Charles Wales and it is expected that it can be placed on the market in the spring of 1912.

Hemming Bros. Inc., Bradley and William Sts., New Haven, Conn., manufacturers of cutlery grinding machinery, have purchased the business of the Charles Greiner Company of that city, manufacturer of automatic wire straightening machinery, grinding and polishing machinery and riveters and will continue the manufacture of the machines as heretofore.

The International Flux Company, manufacturers of foundry fluxes, is to erect a large factory in Evansville, Ind., for the compounding and manufacture of fluxes. The mines of the company are in Hardin County, Ill. The president of the company, M. Jowett, was granted a patent on fluxes for iron and brass in 1910 and the products will be manufactured under this patent.

Personal.

W. Scott Thomas, for the past 13 years in charge of the Western branch of the J. W. Paxson Company, the manufacturers of foundry supplies in Philadelphia, Pa., has taken charge of the Eastern branch of the company in Providence, R. I. Mr. Thomas will be assisted by William T. Nicholson.

George T. Frankenburg, formerly outside foreman of the Cambria Steel Co., Johnstown, Pa., has been appointed superintendent of the Columbus Brass Company of Columbus, Ohio.

George E. Mathies of the Seymour Mfg. Co., of Seymour, Conn. has been elected vice-president of the Hopkins & Allen Arms Company of Norwich, Conn., manufacturers of fire-arms.

Current Metal and Supply Prices.

These Prices are net and are for moderate quantities. Smaller quantities command higher prices. Prices subject to fluctuation.

Acetone, pure, 98-99%	lb.	.22
Acid, Acetic, pure, 30%	lb.	.07
Acid, Arsenious (White Arsenic)	lb.	.20
Acid, Benzoic	lb.	.55
Acid, Boracic (Boric), pure	lb.	.12
Acid, Hydrochloric, see Acid, Muriatic.		
Acid, Hydrofluoric, 30%	lb.	.04
Acid, Hydrofluoric, 50%	lb.	.10
Acid, Muriatic, 20°	lb.	.02
Acid, Muriatic, c. p., 20°	lb.	.07
Acid, Nitric, 38°	lb.	.05⅝
Acid, Nitric, 40°	lb.	.05⅞
Acid, Nitric, 42°	lb.	.06¼
Acid, Nitric, c. p.	lb.	.08
Acid, Sulphuric, 66°	lb.	.01¾
Acid, Sulphuric, c. p.	lb.	.06
Alcohol, Wood	gal.	.50
Alcohol, Denatured	gal.	.55
Alum	lb.	.04
Ammonium Sulphate	lb.	.07
Aluminum, Metallic, in Ingots	lb.	.20
Aqua-Fortis, see Acid, Nitric.		
Ammonia Water (Aqua-Ammonia), 20°	lb.	.04¾
Ammonia Water (Aqua-Ammonia), 26°	lb.	.06¼
Ammonia Water, c. p.	lb.	.08
Ammonium Carbonate, lump	lb.	.15
Ammonium Chloride (Sal-Ammoniac)	lb.	.12
Ammonium Hydrosulphuret	lb.	.30
Ammonium Sulphate	lb.	.07
Ammonium Suphocyanate	lb.	.50
Amyl Acetate	gal.	3.00
Antimony	lb.	.08⅜
Arsenic, Metallic	lb.	.15
Arsenic, White (Acid Arsenious)	lb.	.20
Argols, White (Cream of Tartar)	lb.	.31
Asphaltum, Commercial	lb.	.05
Asphaltum, Egyptian (Bitumen)	lb.	.30
Benzine	gal.	.15
Benzol, Pure	gal.	.75
Bismuth, Metallic	lb.	2.00
Bitumen, see Asphaltum.		
Blue-Vitriol, see Copper Sulphate.		
Borax, Crystals or Powdered	lb.	.10
Borax Glass	lb.	.35
Cadmium, Metallic	lb.	.75
Carbon Bisulphide	lb.	.10
Calcium Carbonate (Precipitated Chalk)	lb	.10
Chrome-Green	lb.	.50
Copper, Lake, (carload)	lb.	.12⅝
Copper, Lake (cask)	lb.	.12⅞
Copper, Electrolytic, (carload)	lb.	12½
Copper, Electrolytic, (cask)	lb.	.12¾
Copper, Casting, (carload)	lb.	12⅜
Copper, Casting, (cask)	lb.	12⅝
Copper Acetate (Verdigris)	lb.	.35
Copper Carbonate, dry	lb.	.25
Copper Sulphate (Blue-Stone)	lb.	.09
Copperas, see Iron Sulphate.		
Corrosive Sublimate, see Mercury Bichloride.		
Cream-Tartar, see Potassium Bitartarate.		
Cryolite	lb.	.12
Cyanide, see Potassium Cyanide.		
Dextrin	lb.	.15
Emery Flour	lb.	.04
Emery, F F & F F F	lb.	.03
Flint, powdered	lb.	.01
Fluor-Spar	lb.	.01¼
Fusel-Oil	gal.	3.00
Gold Chloride	dwt.	.60
Gum Copal	lb.	.30
Gum Guiacum	lb.	.26
Gum Mastic	lb.	.70
Gum Sandarac	lb.	.35
Gum Shellac, brown	lb.	.50
Gum Shellac, white	lb.	.60
Iron Perchloride	lb.	.25
Iron Sulphate (Copperas)	lb.	.05
Lead Acetate (Sugar of Lead)	lb.	.15
Lead, Pig	lb.	.04½
Lead, Red	lb.	.12
Lead, Yellow Oxide (Litharge)	lb.	.12
Liver of Sulphur, see Potassium Sulphide.		
Manganese, Ferro, 80%	lb.	.10
Manganese, Metallic, pure	lb.	.75
Magnesium, Metallic	lb.	1.50
Mercury Bichloride (Corrosive Sublimate)	lb.	.93
Mercury, Metallic (Quicksilver)	lb.	.47½
Mercury Nitrate	lb.	1.50
Mercury Oxide, yellow	lb.	1.80
Nickel and Ammonium Sulphate (Double Salts)	lb.	.08
Nickel Carbonate, dry	lb.	.60
Nickel Chloride	lb.	.50
Nickel Metallic	lb.	.45
Nickel Sulphate (Single Salts)	lb.	.12
Nitre (Saltpetre), see Potassium Nitrate.		
Oil of Vitriol, see Acid, Sulphuric.		
Paraffine	lb.	.15
Phosphorus, yellow	lb.	.40
Phosphorus, red	lb.	1.10
Pitch	lb.	.05
Plaster of Paris, Dental	bbl.	4.00
Platinum Chloride	oz.	25.00
Platinum Metallic	oz.	44.50
Potash-by-Alcohol, in sticks	lb.	.50
Potash, Caustic (Potassium Hydrate)	lb.	.08
Potassium Bichromate	lb.	.14
Potassium Bitartarate (Cream of Tartar)	lb.	.31
Potassium Carbonate (Pearlash)	lb.	.10
Potassium Chlorate	lb.	.15
Potassium Cyanide	lb.	.25
Potassium Iodide	lb.	2.25
Potassium Nitrate (Nitre or Saltpetre)	lb.	.10
Potassium Permanganate	lb.	.17
Potassium, Red Prussiate	lb.	.60
Potassium, Yellow Prussiate	lb.	.24
Potassium Sulphide (Liver of Sulphur)	lb.	.15
Potassium Sulphuret, see Potassium Sulphide.		
Potassium Sulphocyanate	lb.	.70
Pumice, Ground	lb.	.05
Quartz, Powdered	lb.	.01
Rosin, Yellow	lb.	.04
Sal-Ammoniac, see Ammonium Chloride.		
Sal-Soda, see Sodium Carbonate.		
Silver Chloride, dry	oz.	.75
Silver Cyanide	oz.	1.00
Silver, Fine	oz.	.52⅜
Silver Nitrate, crystals	oz.	.50
Soda-Ash	lb.	.05
Sodium Biborate, see Borax.		
Sodium Bisulphite	lb.	.15
Sodium Carbonate (Sal-Soda), crystals	lb.	.02
Sodium Hydrate (Caustic Soda)	lb.	.05
Sodium Hydrate (Caustic Soda) by Alcohol (in sticks)	lb.	.45
Sodium Hyposulphite ("Hypo")	lb.	.04
Sodium Metallic	lb.	.90
Sodium Nitrate	lb.	.05
Sodium Phosphate	lb.	.09
Sodium Silicate (Water-Glass)	lb.	.04
Soot, Calcined	lb.	.15
Spelter, see Zinc.		
Sugar of Lead, see Lead Acetate.		
Sulphur (Brimstone) in lump	lb.	.05
Tin Chloride	lb.	.43
Tin, Metallic	lb.	.42¼
Turpentine, Venice	lb.	.35
Verdigris, see Copper Acetate.		
Water, Distilled	gal.	.15
Water-Glass, see Sodium Silicate.		
Wax, Beeswax, yellow	lb.	.45
Wax, Carnauba	lb.	.70
Whiting (Ground Chalk)	lb.	.02
Zinc Carbonate, dry	lb.	.19
Zinc Chloride	lb.	.12
Zinc, Sulphate	lb.	.06
Zinc, (spelter)	lb.	.06

THE BRASS WORLD AND PLATERS' GUIDE

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Fallacy of Smelting Tin-Dross in a Small Way.

The high price of tin leads to economy. Those who carry on tinning, or melt solder, babbitt-metals, britannia-metal or other tin alloys, all have more or less dross and this, of course, represents considerable money. It is quite natural, therefore, that the producer should desire to reclaim the tin from the dross.

Like many other metallurgical operations, the smelting of tin dross or tin alloy drosses requires appliances not found in the establishment doing tinning or melting the tin alloys, and for this reason the reclaiming of the tin from the drosses is an operation that can hardly be carried out by those who are not equipped for it. Neither can it economically be carried out in a small way and a large amount must be treated. In this connection, however, it may be said that the producer of the dross may reclaim a *portion* of the tin or tin alloy in it by the simple process of "sweating", but the rest must be treated in the regular way by those who are supplied with the equipment.

Dross consists of a mixture of metal, usually in the form of fine shot or pellets, and oxide. The proportion of the two varies to a large extent as it depends upon the care in skimming the molten metal. It is easy to waste the metal by skimming too much off so that by the appearance of such dross one would imagine it to be practically all metal. The average dross, however, does not contain much metal except in the form of shot

The "sweating" of the dross is carried out

by placing it on an iron pan, inclined so that the metal will run off at one corner when melted. A pot or ladle is placed under this corner. A fire is built underneath and the dross heated for some time. When it becomes hot enough to melt the tin, the mass is stirred with an iron rod so as to unite the particles of tin. This stirring is continued from time to time until all the metal shot have united. As they unite they form a larger mass which finally runs down into the pot underneath the pan.

The mass that remains is practically all oxide and must be smelted in a large, special reverberatory furnace, heated by soft coal or oil and with fine coal and a flux in order to reduce the tin to metal. Such a furnace is too expensive to warrant its installation except by those who have occasion to smelt large quantities of dross.

Pure oxide of tin, when free from metal, will contain 78.8% of metal, but the fine oxide or dross will run more in tin content on account of the presence of small or minute shot in it. When one takes into consideration the price that can be obtained for such dross from the regular dross smelters, it will easily be understood that dross melting in a small way is not profitable. The use of a crucible, with charcoal and a flux in place of the large reverberatory is not economical for the reason that the flux attacks the crucible strongly and soon ruins it.

Note on Prevention of Spotting Out of Plated Work.

From the number of instances that have recently come to our notice, we have come to the conclusion that many cases of spotting-out may be overcome by a good rinsing in clean water. This rinsing in reality, becomes a soaking and it will be found very efficacious. The average plater, when he has work which does not bother him by spotting out, simply passes the work through the rinse water in a hurried manner and this suffices to remove the film of plating solution on the surface.

In the case of porous work, like gray-iron or malleable-iron castings, this hurried rinsing or "swishing" will not serve to remove the plating solution from the pores. Then spotting-out follows. The rinsing should be merged into a soaking and the work soaked in *hot* water for some time so as to give the solution in the pores of the metal a chance to work out. The water should be clean. Some platers have found that alternate soaking in hot and cold water is more efficacious than in hot water alone as it serves to "pump", so to speak, the solution from the pores.

While this soaking in water will not cure obstinate cases of spotting-out, it will overcome many of the milder ones which, in reality, should not spot at all when the rinsing is well carried out. We find that insufficient rinsing is a very common error in the plating room.

Is Aluminum Doomed for Automobile Castings?

It is reported that one of the largest automobile companies in the United States is now experimenting with a pressed sheet steel crank case for use in place of the customary aluminum casting, now so extensively employed by automobile manufacturers. With this manufacturer a large stamping company is cooperating and the reports are that the experiment bids fair to be successful. The job is a large one from a pressed steel standpoint, but when one realizes the extent to which the use of pressed steel has been carried in railroad work it may not seem so tremendous after all, and particularly when it is realized what help oxy-acetylene or electric welding can offer.

As a structural material, aluminum, of course, has not been particularly attractive, and in addition castings are being looked upon with less and less favor by automobile manufacturers, so that aluminum really has been "tolerated" for want of something better. Bronzes and other strong metals are too heavy. The use of sheet metal may result in some revelations and some excellent work of this kind has already been done in rear axle housings. It is the only material that can compete with aluminum as far as weight is concerned and if the sheet steel crank case becomes a reality, aluminum will not be used for this purpose, although for other parts of the automobile, where dust and dirt are to be kept out there is no reason why it should not be permanent.

It looks, however, as if the pressed steel people were to attack the field and the matter is of much interest.

Local Shrinkage in Steam-Metal Valves and Its Cause.

Valve manufacturers who use scrap metal metals for making the bodies of their valves, and many of them now do for the cheaper class of goods, occasionally find that their castings have a kind of local shrinkage which makes its appearance from time to time, although not always. The fact that it does not occur regularly indicates that the gating of the pattern is not at fault and one would then naturally think that either the heat of the molten metal at the time of pouring, or the mixture might be at fault. In such instances, it may be said, the mixture will usually be found at fault.

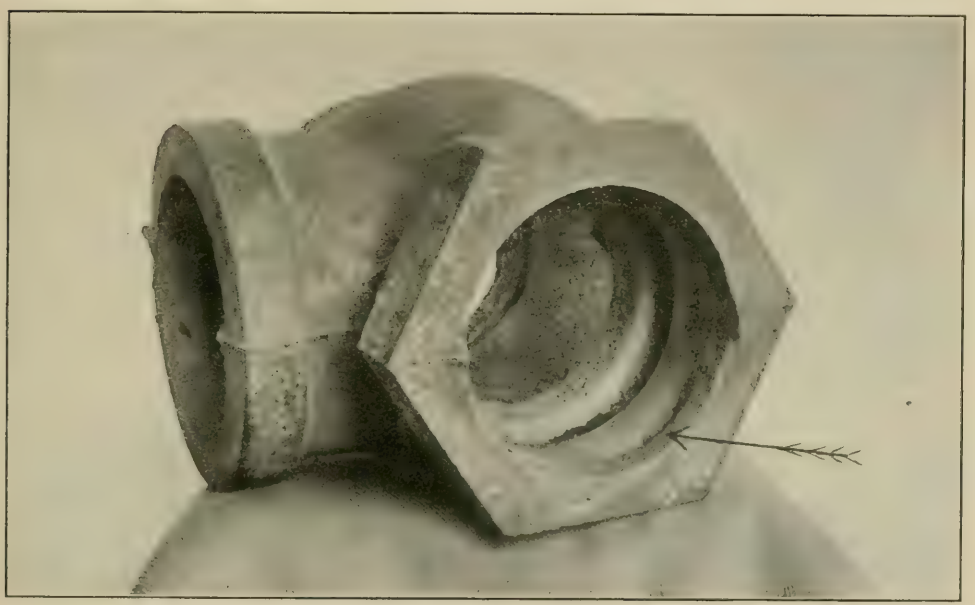


Fig. 1. The Steam-Metal Valve, Showing the Local Shrinkage on the Inside of the "Hex."

An illustration of this kind of shrinkage is herewith shown in Figs. 1 and 2. The valve manufacturer found that his valves of a certain size (2 in. globe valves) were coming with a local shrinkage in them for a whole day. He had used the same pattern for a long time without difficulty and had never had the same kind of shrinkage before. Various pouring temperatures were tried but the results were no better. Ingot composition was being used and this had been found satisfactory for the other parts and for smaller sizes of valves. New metal was then tried and it was found that the shrinkage disappeared and the regular percentage of perfect castings was obtained.

For, this reason, it was assumed that the ingot composition was the cause of the trouble and an investigation proved it to be so. The composition seemed to be good for ordinary work and even for smaller valves, but when it came to this size or larger, the local shrinkage took place. Chemical analysis revealed the cause of the trouble and this was found to be in *the lack of sufficient tin.* Tin as well known, has a tendency to reduce the shrinkage of copper alloys and in the so-called steam-metals, composed of copper, tin, zinc and lead, it has the two-fold purpose of hardening and strengthing the mixture, and also (although not generally appreciated) of preventing excessive or local shrinkage. In the case of the valve herewith illustrated there was not sufficient tin to hold the casting up. An analysis of the valve gave as follows:

Tin 3.15%

While this amount of tin answers for ordinary composition where cost is a matter of

consideration, in the case of a valve body it is hardly sufficient. The best steam-metal manufacturers add from 7 to 8 per-cent of tin to their steam metal mixtures and they then have a strong metal and one that will not shrink locally as the valve herewith illustrated did. It may be of interest to know that the maker of the valve shown overcame his difficulty by the addition of more tin.

In conclusion let it be said that if a valve manufacturer finds that his castings are coming with a local shrinkage of the nature herewith shown, it indicates that too little tin has been used in his mixture and more should be used to avoid it. The tin, therefore, in a steam-metal mixture has an advantage, in addition to strengthening and hardening the mixture, of lessening the shrinkage, particularly of a local nature.

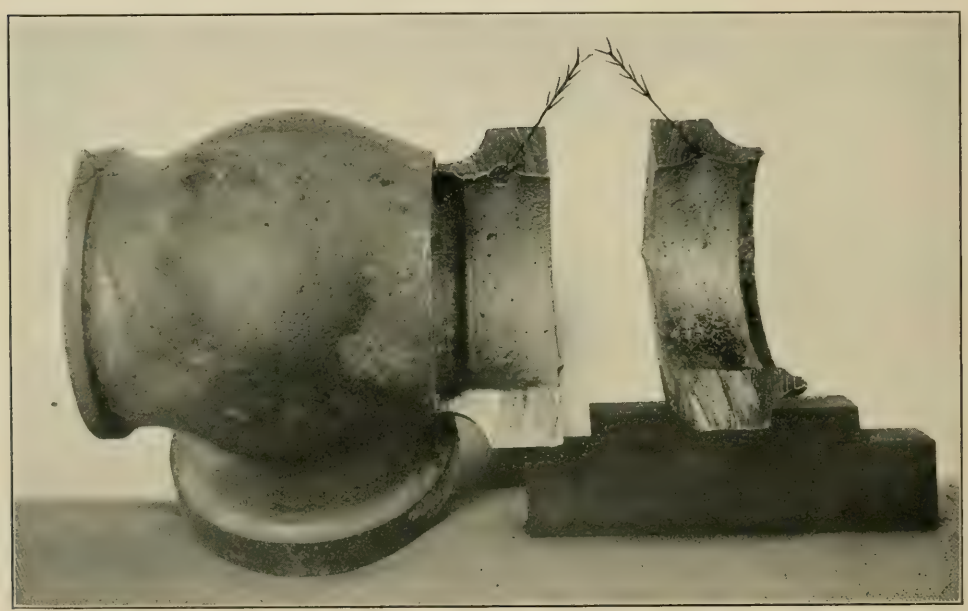


Fig. 2. The "Hex" Cut Away Showing the Manner in Which the Shrinkage Occurs.

A recent experiment in copper melting in an electric furnace produced a peculiar physiologocal action. Some 5,000 lbs. of pure electrolytic copper were melted in a 3 phase arc furnace. After a few hours all of the 10 men employed experienced difficulty in breathing. For the following 24 hours the men were attacked with a severe nausea followed by a soreness of the entire system similar to that of acute *grippe*.

French Method of Melting and Casting Bronzes.

In melting bronzes, Brunet (in *la Fonderie Moderne)* recommends piling the lumps of copper lightly in the crucible, to leave room for expansion, further quantities in a hot condition being added as the copper becomes pasty. When all the charge is in, the metal is heated up until it no longer adheres to an inserted iron rod, whereupon the tin and zinc are added, also in a heated state. With bronzes high in tin the metal should never be allowed to become pasty during alloying, or the bronze will always be unsound. To prevent loss of zinc by volatilization, that metal should be added alternately with the tin, which combines with it, the whole then undergoing dilution in the copper. After incorporating the mixture 0.02 per cent. of phosphorus is added, and the mass is covered with crushed charcoal. Bell metal, being poured at a relatively low temperature should be allowed to cool down in the furnace to cherry-red heat. Bronze 88:10:2 is poured at bright orange heat, and the same applies to bronze 90:10 Air must be excluded from all high copper bronzes by a covering of dry sand. The addition of 2 per cent. of zinc is advisable in all cases, since the flame of this metal is an indi-

cation that the proper pouring temperature of the alloy has been reached. In making phosphor bronzes the chief point is to add the phosphorus at an early stage, the resulting rise in temperature facilitating the melting of the subsequently added metal. The most suitable pouring temperature varies with the amount of phosphorus, and may be ascertained by plunging a small test-bar of iron into the crucible.

An Exhibition of Non-Ferrous Metal Products.

Announcement is made that an exhibition of non-ferrous metals will be held in London, England in the spring of 1912. This will be the first exhibition of this kind that has ever taken place and is to be under the auspices of the Institute of Metals, which has done so much good in the dissemination of metallurgical knowledge.

The exhibition will be called the "International Exhibition of Non-Ferrous Metals", and will be held in the Royal Agricultural Hall, Islington, London, England on May 6th. to 18th, 1912. The president of the Association conducting the exhibition is Sir Gerard Albert Muntz, Bart. of the Muntz Metal Co. of Birmingham, England and the president of the Institute of Metals.

An extensive variety of products of a non-ferrous nature is to be exhibited, and will comprise not only raw materials, but manufactured products of all kinds. Products made of sheet metal, wire and tubing, castings, forgings, metal working machinery, solders, electroplated goods and all kinds of appliances and articles used in the non-ferrous metal trades are to be on exhibition.

Many of the spaces have already been taken and the manager in charge of the exhibits is F. W. Bridges, 119 Finsbury Pavement, London, E. C. England to whom communications should be addressed. We believe many manufacturers in the United States will avail themselves of the opportunity to display their wares.

The use of brass for automobile work is now practically limited to ornamental work and about the only requirement is that it shall be yellow and take a good polish.

Carbonate of Nickel, How to Make It and Its Use in a Nickel Plating Solution.

For neutralizing the excess of free acid in a nickel plating solution carbonate of nickel is the best kind of material as it introduces no foreign matter into the bath. Hydroxide of nickel, made by precipitating sulphate of nickel by caustic soda has been recommended by some writers, and is equally as good as the carbonate of nickel, but it is quite difficult to make. It is a slimy, pasty substance when precipitated that is almost impossible to filter and wash clean. It is not to be recommended on this account.

When carbonate of nickel is added to a nickel plating solution containing free sulphuric acid, the acid dissolves it, forming sulphate of nickel and allowing the carbonic acid gas to escape. In this manner it is possible to regenerate an old nickel solution so that it is brought back to its original condition.

The common difficulty with nickel solutions, especially when run with too few anodes, is its becoming acid. The nickel deposits from the solution, is not replenished from the anodes, and the sulphuric acid in the sulphate of nickel of the double nickel salts is set free. This constantly accumulates so that the work being plated gases very freely and the nickel deposit is slow in forming. A still further condition is that the nickel will refuse to deposit. Such a solution needs only carbonate of nickel to neutralize the free sulphuric acid and return it to its original and good condition. Some platers use ammonia and this, of course, will answer for a time; but if added frequently so much sulphate of ammonia is formed that it becomes excessive. When the ammonia is added to the solution containing free sulphuric acid, only sulphate of ammonia is formed and this is not wanted. With the carbonate of nickel, however, nickel is introduced and this is desired.

The indications of a solution that needs carbonate of nickel are as follows:

1. Work gases freely under the ordinary current strength.
2. Deposition of the nickel is slow.
3. Nickel deposit is apt to burn at the edges.

4. Iron and steel work are frequently pitted.

5. Impossible to obtain a heavy deposit.

To adjust such a solution, the carbonate of nickel is added directly to the solution, with stirring, until no more will dissolve. It has the direct advantage that an excess will do no harm as it will not dissolve, falling down to the bottom of the tank and remaining like so much dirt. It is not advisable, however, to add too much as it is very easy to ascertain when just the right quantity has been introduced.

To make the carbonate of nickel, proceed as follows. Take:

Water	1 gallon
Sulphate of Nickel	8 oz.

Dissolve in the water when heated to nearly boiling. The sulphate of nickel is the so-called "single-salts" and the "double-salts" of sulphate of nickel and ammonia should *not* be used, as the soda subsequently added will liberate the ammonia and will dissolve some of the carbonate of nickel formed.

Make up a second solution as follows:

Water	1 gallon
Carbonate of Soda	1 lb.

Heat nearly to boiling and add, little by little to the sulphate of nickel solution. This will give a green precipitate. Add the carbonate of soda solution until no more green precipitate forms. While the addition of the carbonate of soda is being made the whole should be stirred with a wooden stick. The precipitation can be carried out in a barrel or stone-crock according to the volume used.

Allow the solution to settle, siphon off the clear solution, pour fresh hot water on the green carbonate of nickel in the bottom of the barrel and stir up. Allow to settle and again siphon off the clear solution. Repeat this several times and pour the carbonate of nickel on a cloth filter to remove the last of the solution. When completely drained out, pour hot water over it several times and allow to run out each time. This serves to wash out all foreign matter.

The carbonate of nickel thus obtained is a green, pasty mass and it should be kept in this condition. *It should not be allowed to dry,* as it then becomes hard and lumpy and will not dissolve well. The wet condition is the best and as such is called "plastic carbonate of nickel."

Distinguishing White-Brass from Babbitt-Metal.

By H. D. Gehret.

The following method of distinguishing between white-brass and babbitt-metal may not generally be known and will, perhaps, be appreciated by some of the readers.

While the writer was engaged as chemist for the E. R. Thomas Motor Co., of Buffalo, N. Y., shipments of Parsons' White-Brass and Superior Babbitt-Metal had, in some manner, been placed together in the same stock bin. The parts in question were exactly of the same size and form, differing only in composition.

Parson's White-Brass contained the following:

Tin	68.0%
Zinc	30.0%
Copper	2.0%

Superior Babbitt-Metal had the following composition:

Tin	92.6%
Antimony	3.7%
Copper	3.7%

The laboratory was called upon to separate the parts and it was found, if a drop of strong nitric acid be placed on Superior Babbitt Metal, a very dark colored ring is immediately formed around the edge of acid. The treatment of the Parson's White Brass by the same acid causes merely a slight discoloration. By this means the entire lot was separated without destroying even a single piece.

An alloy of equal parts of nickel and aluminum is subject to spontaneous disintegration. An ingot of this alloy will disintegrate to a powder in a few months by simply standing in the air. The disintegration is not caused by oxidation for the alloy in the form of powder has the same composition as the ingot.

Tellurium is a metal which is almost on the dividing line between the metals and non-metallic elements. It is brittle and crystalline and resembles arsenic more than any other substance. Although common and could be cheaply produced were there a demand for it, no commercial use has yet been found for it.

Observations on Nickel Mining in Canada and Its Relation to the Manufacture of Nickel Anodes.

By George L. Wallace.

Thinking that the readers of THE BRASS WORLD might be interested in the production of metallic nickel, some observations made during the past summer in the Canadian nickel country may prove worthy of attention. The observations were made in the Creighton mines in the Sudbury region of Ontario, Canada, and I will endeavor to describe, as I myself saw them, the different operations through which the nickel ore goes before it is ready to cast into the commercial nickel anode. Through the courtesy of A. P. Turner, president of the Canadian Copper Co., Mr. Brown, chief chemist and Supt. Hambly of the Creighton mines, I was enabled to follow the production from the ground to the final smelting of the ore.

Fig. 1. The Town of Creighton, Ont., Canada in Which is Situated the Creighton Nickel Mine.

Imagine, if you can, a hole in the ground 900 feet long, 600 feet wide and 400 feet deep, with shafts and tunnels going out at different directions, and you can, in your mind's eye see the Creighton mine, the largest individual nickel mine in the world. This mine is shown in Fig. 2. In Fig. 1 the town of Creighton is illustrated. The mine, however, is only one of a chain operated by the Canadian Copper Co.

To commence mining the ore, the surface is first cleaned of soil, trees, etc., and the croppings of ore removed, as well as the granite top layer. Underneath the combined ores are found and they are composed of nickel, copper, sulphur and arsenic with some pyrites. The average percentage of so-called workable metals is from 4 to 5 per-cent of nickel, and 1½ to 2 per-cent of copper, so that it can readily be appreciated that a large amount of ore must be removed every day to keep the production up to the demand.

The ore is first blasted out and hoisted to the crusher house 100 feet above the surface where it is crushed into pieces about the size of one's fist, after which it passes over an endless conveyor and is sorted by boys so that much of the granite and other material of a foreign nature is picked out and thrown aside into huge bins. The good ore is carried along and dumped into other bins from which

Fig. 2. The Creighton Nickel Mine in Creighton, Ont., Canada.

it drops directly into freight cars, the good ore into one car and the refuse into another. The good ore is then taken in the car directly to the smelter. The refuse is used to fill up the swamps, build railroad beds, roads, etc.

After the good ore reaches the smelter, it goes to the roast charge, which is made as follows: Cord-wood is piled up into a bed 80 feet long, 40 feet wide and 4 feet high. On top of this the ore is piled and the wood started burning. After a while the sulphur in the ore starts to burn and the fire is kept smouldering for from 5 to 8 months until the principal part of the sulphur has been burned out. The ore then looks like an old coal cinder.

In this shape, after roasting, it is taken to the smelter. This is of the Bessemer converter type and a charge of the roasted ore, combined with the necessary amount of limestone and coke is placed in it and the fire and air applied. It takes from 18 to 20 hours for

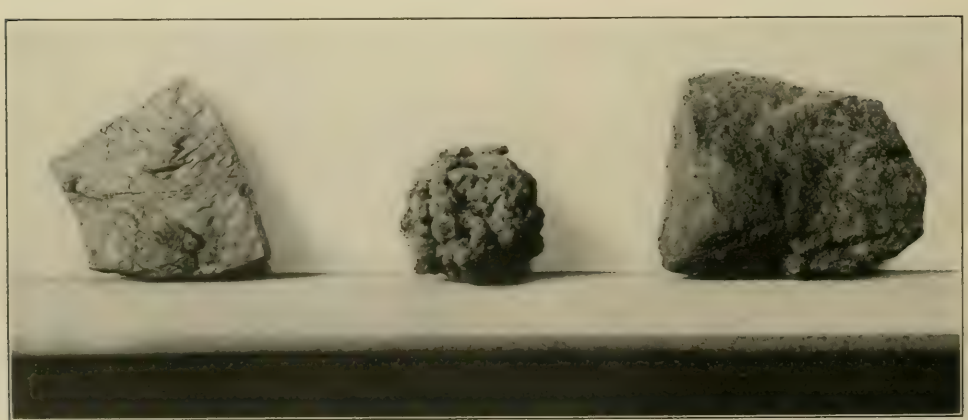


Fig. 3. The Matt. Roasted Ore. The Ore.

this process, after which it is allowed to run out into ladles holding approximately 3 tons. From these ladles, the melted mass is poured into pans arranged in the form of a huge merry-go-round. These pans are shallow and as the table makes one turn, the mass has cooled sufficiently to allow dumping to take place. The material thus obtained is known as "nickel-matt" and contains 80% nickel and 20% copper, most of the iron, sulphur and other foreign elements, having been removed in the converter.

The blocks of matt are then sent to the refining plant and the copper and nickel separated and during the process the pure metals, nickel and copper are obtained as well as nickel sulphate and copper sulphate. These products are then ready to send to the metal workers and platers for use in making alloys, anodes or solutions.

I will say a few words about the mines, the number of operators employed and the motive power. There are employed in the mines and smelters approximately 10,000 men and the product is 80 tons of nickel matt per day. Operations are carried on 24 hours per day and 7 days per week.

The motive power is electric, the main station being on the Victoria River and composed of turbine water wheels directly connected to alternating current generators of 29,000 volts with an aggregate of 30,000 horsepower. This station is about 30 miles from the smelter and the current is sent over the lines at 29,000 volts and then transformed to 550 volts so that it can be used at every part of the works operated electrically. The towns connected with the works are lighted by the current and the houses are also lighted as well.

At the mines the miners are provided with a fine building for a wash house in which they have ventilated steel lockers for holding their clothes, sinks, shower baths, hot and cold water and other conveniences of a modern nature. Every part of the mines and grounds is kept very clean and rigid sanitary rules are enforced.

The pitting of nickel deposits may be prevented by the use of a large quantity of boracic acid in the nickel plating solution. From 5 to 6 oz. of boracic acid in each gallon of nickel solution, and in addition to the prevention of pitting, it will give a whiter deposit.

The Application of Graphite to the Production of Crucibles for Melting Metals.

Concluded from THE BRASS WORLD, Sept. 1911, page 307.

As a substitute for hand work, the crucible press has been brought out. Wernicke* forms the crucible in an inverted position and allows the core to remain in the mold, while Nicolas Joseph Dor** uses a hydraulic press for the manufacture of clay crucibles for the melting of steel.

By means of the press of Röhr & Sohn*** the crucible is forced into the mold by a plunger the size and shape of the inside. When completed, the plunger is removed and the crucible forced out of the bottom of the mold by a plate on the bottom and made movable.

Another form of press, of only about a fourth or fifth of the large press in capacity, is used for the manufacture of the small sizes of crucibles.

By means of a centrifugal machine, Gautier & Co., of Jersey City, North America, manufacture their crucibles. The mixed crucible material is placed in a plaster of Paris mold, which is then placed on a potter's wheel revolving at the desired speed. By means of the centrifugal motion, the crucible mass is formed into the desired shape.

The drying of the crucibles must be carried out slowly, and in order to avoid cracking, the temperature is raised gradually. Factories which manufacture crucibles for their own needs do not usually burn them, yet such crucibles must be slowly heated before using. Otherwise graphite crucibles must be slowly heated to a moderately low temperature (Segercone about 0.10 to 0.18). For this purpose they are burned in kilns or muffles so as to avoid burning out the graphite on the surface. In the former case, the space between the crucible and cover is, moreover, filled with powdered coke or sand so as to avoid this burning out. If, however, the crucibles are heated so that the graphite is burned out on the surface so that it becomes red or gray, graphite is rubbed into them to restore the black, shiny appearance.

To protect the crucibles from the chemical action of the charge and vice-versa, from the constituents of the shell; or to prevent the

*German Patent No. 19,337.
**German Patent No. 25,130.
***German Patent No. 61,267.

absorption of moisture which causes them to crack while in use; or to increase the resistance of the lining against high temperatures, various practices have been devised:

1. Tann proposes, as a lining for crucibles to withstand high temperatures (i. e. for melting manganese ores), 1 part of refractory clay and 3 parts of graphite in a layer of maximum thickness of 15 m.m. (3/5 in).

2. According to the German imperial patent No. 5121, the crucibles are filled with carbon by dipping them in tar and afterwards heating to a moderate temperature in a reducing furnace.

3. Peto protects the crucibles from the absorption of moisture in storage by giving them a coat of varnish of rosin, gums or pitch which are dissolved in turpentine, wood spirits or grain alcohol. A simple coat of lacquer also suffices.

4. Glazing is also applied and to produce this a soda solution or a coating of water-glass is often employed, or according to Peto, a salt-glaze such as is used for pottery.

5. As a protection of the melt against the reducing influence of the graphite, the crucible works in Hainsberg use the following lining:

Refractory Plastic Clay	2 parts
Magnesite	2 parts
Quartz	1 part

The mass is worked together in a mixer rubbed in, and forms after burning, an inner lining.

6. Finally, to increase the resistance to high temperatures by coatings, Engels provides a covering of carbide which, according to the first patent, was to be melted on by means of the electric arc; while the second patent concerns a procedure for the preparation of a refractory coating of carborundum. In this case, the material to be made refractory, which is already burnt and dried and consequently hard, is accomplished by rubbing the carborundum upon the crucible to be coated. Water-glass or boracic acid serves as special binding material which may be helpful. In the case of soft material not yet burnt, the carborundum is scattered and rubbed on without the use of any binder, but the crucible must be subjected to another baking.

7. The Chemical Thermo-Industry, however uses molten carborundum, and in order to have it flow into the crucible, the crucible itself is previously heated to redness. In this way, by tilting or turning the liquid mass about, the walls of the crucible are covered with a coat of crystalline carborundum which solidifies immediately. As a result, this sort of crucible imparts no carbon to the charge in the melting of metals and their alloys.

In conclusion it may be said that the most recent improvement in the manufacture of graphite crucibles is the process of Dr. Heinrich Putz of Passau. This process consists in coating the surface of the crucible with a carbonaceous material such as rosin, tar, paraffine or a similar product. Moisture is thus prevented from penetrating the crucible and the cracking or scalping when placed in the fire is thus obviated.

Note on the Cause of the Disintegration of Aluminum.

In subjecting specimens of spontaneously disintegrated aluminum to microscopical examination. Le Chatelier, in the *Revue de Métallurgie*, explains that he has discovered distinct indications of cellular structure. The cause is not yet ascertained, but is believed to be due to excessive reheating during the process of working the metal (stamping into mess-tins, &c.) or to crystallisation at ordinary temperatures, especially when the metal contains impurities such as calcium. Once the cellular structure makes its appearance it may easily become extended by the action of reagents—even hard water—or by mechanical stresses due to fluctuations of temperature. Disintegration has also been traced to the effects of cold working, in which case reheating to 450° C. affords a remedy. This circumstance points to the risk attending endeavours to harden metals in general by cold working.

Cartridge brass is the purest form of brass known to the trade as the requirements are that only the purest copper and spelter be used. Such brass contains the least amount of lead and iron.

The addition of a small amount of tin to sterling-silver will harden it so that it is possible to produce a stiff and resilient sheet metal or wire by its employment. At one time it was proposed to use such an alloy for the manufacture of sterling silver forks, but it did not become prevalent on account of the difficulty of keeping the scrap, resulting from the manufacture, separate from ordinary sterling-silver.

An Appliance for Preventing the Escape of Zinc Fumes in Brass Melting, and Reducing the Melt Loss of the Brass.

One of the worst features of the brass foundry is the escape of zinc from the molten brass in the shape of zinc oxide or "spelter fumes" as they are usually termed. Not only does this escape of zinc result in a financial loss to the foundryman, but it has an injurious effect on the employees of the foundry. "Spelter-chills", induced by the zinc oxide, is

Fig. 1. Crucible of Melted Bass, Showing How Zinc Oxide is Given Off.

a very prevalent ailment and those who have followed the brass trade for any length of time invariably have an attack. Later they become more or less immune, but the zinc still has an injurious effect.

While it has been found impossible absolutely to prevent the escape of the zinc from a crucible of melted brass, the use of special devices greatly reduces this escape and thus renders the melt loss lower than that obtained in ordinary practice, to say nothing of the influence upon the health of the operatives of the brass foundry or casting shop.

An appliance of this kind has been devised and patented by T. J. MacGrath, foreman of the brass foundry of the E. Stebbins Mfg. Co. of Springfield, Mass., manufacturers of plumbers' brass goods, and which is herewith illustrated. The device is in the form of a cover, made of iron so that it fits over the top of a crucible in which the brass is melted. Various sizes are made for the different sizes of crucibles.

The appliance is placed on the crucible when withdrawn from the fire and after skimming. The fingers at the sides serve to hold the cover on the crucible. An eye bolt in the top allows it to be handled by the skimmer or tongs when hot.

In Fig. 1 is shown a crucible of brass as it comes from the furnace with the brass at the temperature necessary for pouring the mold. It is well known that brass must be poured "hot" in order to obtain the desired filling of

Fig. 2. Crucible of Brass With the Cover on, Showing How the Zinc is Prevented from Escaping.

the mold, and this results in a large escape of zinc. It is well known that zinc will not escape to but a slight extent if the surface of the melted brass is protected from oxidation. It appears to be the oxidation of the zinc on

Fig. 3. Manner of Placing the Cover on.

the surface that causes the escape. For this reason the crucible cover is efficacious.

The pouring is done while the cover is on the crucible so that the escape of zinc during this operation is reduced to a minimum. The molder who does the pouring is likewise prevented from becoming injured.

Fig. 4. Detail of the Cover.

In the use of the crucible cover the quality of the metal is increased for the reason that oxide, as well known, is a deleterious substance in metals. The cover prevents the formation of this oxide and so increases the quality of the brass.

In Fig. 2 is shown the crucible with the cover on and the elimination of the zinc oxide fumes. In Fig. 3 is illustrated the manner of placing the cover on or taking it off. In Fig. 4 is shown the detail of the cover and the method of holding it on the crucible. The cover will last for a year or more and is comparatively inexpensive. It is stated by the inventor that a saving of 1% is obtained when the cover is used on yellow brass work, and from ¾% to 1% when employed in the melting of composition or bronze. The cover is being placed on the market for use in the brass foundry trade by the inventor.

New Method of Purifying Alloys.

A new method of purifying alloys has been patented by two Englishmen, George Bryant of Finsbury Park, London and Charles H. Ivinson of Ilford.

The metal to be purified is passed through a sieve, while in the melted state, and allowed to fall into a suitable flux. The fine state of division, they claim, results in complete purification of the metal or alloy.

They cite, as an example, the purification of zinc. This metal is melted and passed through the sieve and allowed to drop into a solution of phosphorus in oil and a zinc chloride solution, the oil floating on the latter solution. It is claimed that such purified zinc makes brass, when alloyed with copper, free from oxide and of a very much better quality than otherwise.

Tin-bronze containing lead is more readily corroded than that which is free from it.

When zinc is heated to a temperature slightly above the boiling point of water, it loses its crystalline character and may be rolled into sheet or drawn into wire. For this reason all zinc is rolled hot and it is quite soft at the temperature used for rolling.

The Brittleness of Heavy Brass Deposits.

The demand for brass plating was never so great as at the present time. By its use it is possible to produce a brass effect on cast-iron or steel with a great saving in cost, and at the same time, in instances where necessary, the brass effect with a strength of steel may be obtained.

The ordinary difficulty with brass plated objects is that the brass deposit is too thin and soon wears away so that the life of the plating is too short. This is particularly noticeable in the case of automobile work, in which brass plating is done to a large extent, as scouring must frequently be carried out in order to maintain the brass in a bright and clean condition. The brass deposit is then rapidly destroyed or worn away.

In order to produce a heavy brass deposit that will wear the necessary amount, it is customary to "force" the brass plating solution to its utmost degree. This is done to deposit a good thickness in the shortest possible time. Platers must do this or the plating will consume too long a time.

The fact that such heavy brass deposits are hard and brittle is not generally known, for the reason that the majority of brass deposits are light and there is no opportunity to ascertain whether the brass is hard or soft. In fact, with a light deposit, a hard brass may be beneficial as it wears longer than a soft one. Soft deposits are obtained by depositing the brass very slowly, while a hard one is formed when the brass is forced on to the surface with a strong current. In the illustration are shown brass deposits of considerable thickness and which were quite hard and brittle. The ring was one of iron plated with brass to a thickness of about ⅛ of an inch in an ordinary brass solution made up of carbonates of copper and zinc with cyanide. The sheet was plated in a brass solution made up of cyanide and the cyanides of copper and zinc. This is supposed to produce a softer deposit than the other. In this case the brass was deposited to a thickness of about 1/16 of a inch and

Articles Brass Plated, Showing Brittleness of the Heavy Deposit.

the brittleness may be noticed. In both instances the deposit was so brittle that it could easily be broken and would stand bending but slightly. The ring was harder than the sheet, and this may be accounted for by the fact that it was heavier.

The cause of the hardness of heavy brass deposits is the occlusion or absorption of hydrogen. When the brass is deposited, there are

given off from it bubbles of hydrogen gas. The quantity of the gas evolved depends upon the rapidity with which the brass is deposited or, in other words the current density. If a very strong current is employed, the evolution of hydrogen gas is strong. With a weak current the amount given off is small. Therefore, brass deposited with a weak current does not occlude as much hydrogen as one plated with a strong current and hence is softer.

In order to realize this hydrogen gas absorption, all that is necessary is to strip it from the cathode plate upon which the heavy brass deposit has been made, and heat to a red heat. This process will serve to expel the gas and leave the brass in a soft condition. In the articles illustrated, the heating was carried out when it was found that the brass deposit, previously hard and brittle, became soft and tough like ordinary soft brass. While this process may be called an "annealing" in the ordinary meaning of the word, it is, in reality a gas expulsion. It has been found to work equally as well on other deposits as on brass, but in the case of nickel, iron and other oxidizable metals, it is necessary to heat them in a non-oxidizing atmosphere.

A New Anti-Friction Metal.

A new anti-friction metal has been patented by Walter Wyers of Norristown, Pa. It consists of the following metals:

Zinc	78%
Copper	12%
Lead	7%
Iron	2%
Manganese	1%

The inventor says: "Its anti-frictional qualities make it possible to replace the metals in many instances where more expensive metals are in use for bearings, bushings and numerous other castings. When in a finished casting, it will hold its lustre for a great length of time. The component parts of the alloy being of an anti-frictional nature, make it less subject to the action of heat and, therefore, less lubrication is necessary."

The method of introducing the iron and manganese is not given in the patent.

Galvanizing Wire in Zinc Dust.*

By Alfred Sang.

Ever since I presented before the American Electrochemical Society my first paper on galvanizing steel wire by heating it electrically in zinc oxide or zinc dust, I have realized that a perfectly clear conception of the forces at work was essential for the successful operation of the process. Once the nature of zinc dust was well understood and the action which different temperatures may have on it was clearly demonstrated, the application of the process was found to be, after all, not nearly as complicated as might have been feared, in fact it was less complicated than the other two processes in general use.

It must be recalled that zinc dust does not melt when heated to a temperature of fusion of zinc, but a higher temperature reducing agent will "precipitate" the metal, as it were, and it can also be squeezed out under mechanical pressure. This property of resisting fusion is supposed and is probably due to the surface of each particle being formed of zinc oxide or zinc carbonate.

If zinc dust is heated evenly, the temperature is found to rise steadily until around 390° C. when the rise becomes much more rapid, attaining its maximum rate at about 420° C., and then falling gradually until in the neighborhood of 470° when it becomes normal. When the dust is cooled down an opposite effect is noticed between 450° C. and 260° C. If the operations of alternately heating and cooling the same dust are repeated, the exothermic and endothermic effects are manifested each time between the same temperatures with their apices at about 420° C. on the rise and about 350° C. on the fall.

We cannot help but notice that the exothermic effect on the rise occurs at the melting point of zinc metal, but when zinc is melted the effect is the very reverse, heat being absorbed at the moment of fusion to the extent of 28 Calories per kilogram.

We are therefore in presence of an anomalous critical point, and I will now consider separately the operations of galvanizing in zinc dust below and above that critical point.

*A paper presented at the Meeting of the American Electrochemical Society held in Toronto, Canada, Sept. 21-23, 1911.

If a clean piece of steel wire is immersed in zinc dust which is heated to a temperature below 420°, or what is known as "sherardizing temperatures," a slow cementation takes place and zinc is absorbed from the very moment that the wire reaches the temperature of the dust there is at the same time a slow sublimation of zinc at the surface increasing with time but sufficient for all practical purposes after a few hours of treatment; in the presence of reducing gases the time of treatment can be considerably lessened but the penetration of zinc is of course less. This process is sherardizing, unsurpassed for many purposes, unsuitable for many others. There are two varieties of sherardizing coatings: the gray, porous and brittle variety, mostly composed of zinc carbonate which darkens with age; other variety has a high metallic luster and is compact and of a finely crystalline structure. If this were the class of sherardizing produced by all existing plants, there would not be much hot-galvanized work produced outside of wire and sheets.

When we work with the dust at a temperature above the critical 420°, results are entirely different; galvanizing is *instantaneous*, taking place the very instant that the wire reaches the temperature of the dust. There is very little penetration of zinc in the iron; there may be vaporization and condensation of zinc as in sherardizing, although I doubt it. A wire heated to 800 or 900° in a non-oxidizing flame and quickly thrust into cold zinc dust will condense around itself a considerable thickness of zinc. The best working temperature ranges between 500 and 600° C. The galvanizing is bright and more pleasing in appearance than that obtained by any other means.

I will not go into details of the furnace used, which merely consists of a zinc-dust trough between two sand troughs provided with a set of cast-iron cover-plates over the zinc trough and power-driven rolls. As high a speed as 850 feet per minute can be used for securing good merchant galvanizing. It is found preferable to run at 35 feet only, running a large number of strands and attaching the coils end to end.

The process is economical as regards current consumption which, outside of zinc and labor with a very small amount of power for driving the rolls represents the bulk of direct cost.

While the wire is softened by the process, a full annealing can only be secured by using a higher temperature, the consumption of electric energy being then increased from 40 to 50 per cent and the sand trough, through which the wire passes after leaving the zinc dust must be appreciably lengthened. If a slight scale is to be removed, the higher temperature must be used in connection with the reducing agent. Sand must be used with the zinc dust to prevent caking and cavitation in the path of the wire. Aluminum contact rolls and special mercury contacts are the only ones suitable for this kind of a plant.

The wire can be brought into the air immediately after coating; but it is preferable to let it cool by passing it through sand which brightens it at the same time.

The instantaneous galvanizing of steel in zinc dust above 420° is readily explained by completing the theory which I developed as far back as 1907; I will now state it in its complete form:

Zinc dust is produced by the sudden cooling of the vapor of zinc and the transition from the gaseous to the solid state is so rapid that, for all practical purposes, the liquid state is skipped. The setting of the zinc, brought about by sudden chilling, prevents regular arrangement of the molecules along determined stereochemical lines; it forbids the formation of crystals for which time is required. The heat of solution of matter in an amorphous state is always higher than when in a crystalline state; the same is true of a strained condition which likewise presents an amorphous appearance. At the time of formation, considerable heat is retained which would have been radiated by slow cooling. The condition is one of physical instability resulting in readier and, oftentimes, explosive decomposition.

The physical instability of zinc dust may be explained thus: in the prolongs of zinc furnaces the uncondensed vapor is suddenly chilled and collects in minute drops which are instantly congealed at the surface and oxidized, forming a rigid spherical skin or crust. Within this crust the liquid zinc cools and contracts more slowly but the rigidity of the crust does not permit the drawing in of the surface to form the facets of a crystal and compensate this internal contraction. Thus, voids must exist within the crust and we may presume a structure which might be described as "piped radially" or as negatively crystalline.

Below the melting point of zinc this condition persists but affinities and thermal inducements find a readier response from zinc dust than from any other form of zinc, both by reason of the enormous amount of free surface and because of this unstable condition.

At about 415°, which is the melting point of zinc, the strain within the zinc dust particle is totally or almost totallly relieved as indicated by the loss of heat, although some of the latent heat must be retained for fusion.

At high temperatures zinc dust is pasty, because formed of innumerable little bags of melted zinc, but these will not coalesce on account of their small size and closely packed condition, unless considerable pressure is used. These minute bladders might be compared to soft-shell turtle's eggs; they form a plastic and cellular mass.

If, however, a reducing agent, say a drop of coal tar, is introduced, reduction of the skin takes place and we get a small mass of more or less spongy metallic zinc. If a metal which is electronegative to zinc, such as iron, is put into contact with these bags of zinc, reduction and an exchange of metals take place, the bag is punctured at the point of contact and the zinc spreads itself on the iron.

Hence it is that wire can be galvanized in this manner by means of a plant closely resembling a hot galvanizing plant, for the process is, in fact, one of hot galvanizing.

For electroplating, cast-iron should be sandblasted, if possible, in preference to pickling, for the removal of the scale and rust, as there is then much less danger of spotting out.

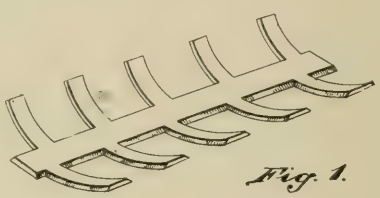
Manufacturers of silver-plated flat-ware now all use practically the same solution for the electrodeposition of the silver. It consists of about 3 oz. of silver and 3 oz. of free cyanide in each gallon of solution.

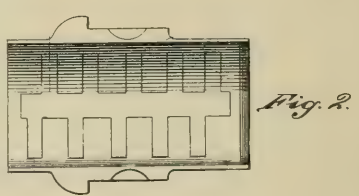
Cast-iron that has been pickled a long time in acid has the iron removed at the surface, leaving a skin of graphite. Such iron is called "over-pickled" and is difficult to electroplate for the reason that the surface is not a good conductor of the electric current and the deposit does not cover well or rapidly. For plating such iron, a hot,cyanide copper solution is the best; in fact, it is frequently impossible to electroplate it in any other manner.

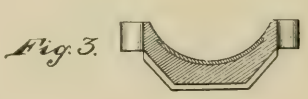
A Novel Method of Making a Graphite and Bronze Bearing.

A novel method of making a graphite bearing has recently been patented by John B. Mendenhall of Kansas City, Mo. The ordinary way of making such a bearing is to force the graphite material into the recess cast in the bronze or brass shell. According to this new method, however, such a practice does not give as satisfactory results as desired.

The patented process of making the graphite bearing is as follows:







Manner of Making the Graphite Bearing.

Graphite of a kind suited for lubrication is mixed with soap or tallow as a binder so that the mass has about the consistency of putty. This mass is next compressed in a suitable mold so that it has the shape illustrated in Fig. 1. This is then baked so that it becomes hard and may be handled readily. The hard graphite thus made is set into the mold in the same manner that a core would be used and the metal cast in the usual way.

The graphite thus becomes permanently and strongly imbedded in the brass and is not liable to become displaced.

The Silver Industry of Sheffield, England.*

By Ernest A. Smith, A. R. S. M.,†

The manufacture of sterling-silver wares and of silver-plated wares is a branch of Sheffield trade of considerable importance. It shares with cutlery the honor of being a staple industry of the city, and has taken a great and increasing part in building up Sheffield's fame. From the beginning, the silver trade has been intimately connected with the cutlery trade. The origin dates from the middle of the eighteenth century, and can be traced as an off-shoot of the older industry, the manufacture of cutlery, for which the city has so long been famous.

The silver industry began when the art of "silver-plating" was invented in the year 1742 by an ingenious mechanic, Thomas Bolsover, who was a member of the Cutler's Company. When repairing the handle of a knife, composed partly of silver and partly of copper, he accidentally fused the metals, causing them to adhere one to another, and this accident suggested to Bolsover the possibility of a process of coating copper with silver so as to present the appearance of silver, and thus obtain a substitute for solid silver ware which should be less expensive but not an imitation. Bolsover succeeded in carrying out this idea and manufactured small articles in plated silver. This was the starting point of a very important industry, namely, the manufacture of the celebrated *Sheffield Plate*, which flourished for a hundred years and then gave place to the process of silver-plating by electro-deposition, known as electro-plating. This process was introduced in 1840, and thence forward plating by Bolsover's process declined and by about 1850 had almost died out.

The silver plating process pursued in the manufacture of old Sheffield Plate consisted in taking an ingot of copper, slightly alloyed with brass, and a thinner ingot of silver, finer than the standard, and placing them in close contact after their surfaces had been scraped clean and even. The silver was then protected by a thin sheet of copper and a sheet of iron outside of that. The whole was tightly bound together with iron wire, and the edges brushed together with a solution of borax to prevent oxidation in the subsequent heating. The ingot was next very carefully heated in a reverberatory furnace until the silver began to fuse and was seen to flow at the edges. It was then quickly removed from the furnace, gradually cooled and when cold cleaned in an acid solution, after which it was scoured with sand and water and rolled out to the desired thickness. For the purposes of manufacture it was cut up and hammered into the required shape by skilled workmen or stamped in dies, the edges and parts being soldered together at a moderate heat, and finally burnished by hand. In the early days of silver plating, the manufacture of buttons and buckles was an immense industry, and Bolsover at once established a factory in Baker's Hill for the production of these and other small articles such as snuff boxes etc. He experienced great difficulty in regard to labor, and at first, he and others who followed him, had to accept the services of itinerant tinkers, and such workmen as they could induce to come from London and other places—men who speedily realized their importance and exacted their own terms.

For the first fifty years, the copper was plated with silver upon one side only, but Bolsover's apprentice, Joseph Hancock, improved upon the process and plated both sides, at the same time extending its application to larger articles, such as tankards, coffee pots etc. Tin was at first applied to hide the raw edges of the copper or brass, but in 1784, George Cadman, in partnership with Samuel Roberts, substituted solid silver edges and mounts, thus not only hiding an obvious disfigurement, but also protecting the parts most exposed to wear. The earliest forms of Sheffield Plate are generally plain and simple in design, but later the designs were pierced like the silver-pierced work of about the middle of the eighteenth century. As a general rule, Sheffield Plate simply reproduced the patterns of solid silver in use at that time.

The old Sheffield Plate, which, as stated above, represents the earliest form of silver plating, was exceedingly durable. At the present time it is much sought after by collectors and when genuine usually commands a high price. Several fine examples of Sheffield Plate may be seen in the Weston Park Museum.

*Journal of the Society of Chemical Industry, Aug. 31, 1911, page 997.

†Deputy Assay Master, Sheffield Assay Office, Sheffield, England.

Electroplating.—The method now used was discovered in 1840 by a surgeon, Mr. John Wright, a native of Lincolnshire, England, who was for some time assistant to Dr. Shearman of Rotherman, but afterwards practised in Attercliffe, and subsequently removed to Birmingham.

Dr. Wright appears to have been a great experimentalist, and Dr. H. Clifton Sorby has recorded the fact that in the early days he and Dr. Wright used to meet and experiment at the laboratory of Mr. Lucas who was the scientific chemist at the silver refinery at Attercliffe. Dr. Percy, the famous metallurgist, states (in his Metallurgy of Silver, page 115) that: "Mr. Wright informed him that he (i. e. Mr. Wright) was led to this invention from reading the following passage in Scheele's Memoir on Prussian-Blue":—"It is remarkable that our coloring matter (hydrocyanic acid) after it has united with alkali, or with the lime, forms a menstruum, capable of dissolving not only metallic calces, but also of constituting a triple salt, which is not decomposed by the aerial acid as happens with the *lixivium sanguinis* (i. e. aqueous solution of cyanide of potassium) and the precipitating l'quor, when exposed to the free access of air. Iron is not the only metal which has the property of fixing the coloring matter. The same quality belongs likewise to gold, silver, copper and probably to several other metallic calces; for if, after these calces have been precipitated, a sufficient quantity of precipitating liquor be added, in order to redissolve them, the solution remains clear in the open air, and in this, the aerial acid does not precipitate the metallic calx."

A patent was granted for the use of cyanide of potassium in electroplating to Messrs. George Richards Elkington and Henry Elkington in 1840, Mr. Wright having sold his invention to those gentlemen on condition of receiving one shilling per ounce of silver deposited. The patent ought legally to have been taken out in the name of the inventor.

The process was first introduced into Sheffield in 1843 by the late Mr. John Harrison of Norfolk Works, Scotland Street who, being impressed with its merits, obtained from Messrs. Elkington a license to use the process, and sent Mr. George Walker (whom he engaged as an operative plater) to be instructed at Messrs. Elkington's works in Birmingham.

On July 1st., 1843, Mr. Harrison advertised in the "Sheffield Independent", that he had commenced the business of electroplating etc. with Elkington's patent. Mr. Walker ultimately commenced electroplating on his own account in 1845 and was the founder of the firm of Walker & Hall, now carrying on the trade in Sheffield. In the early days of electroplating, the electric current was generated by means of a series of small electric batteries, but subsequently "magneto-electric" machines were introduced. One of the first machines in use was patented by Mr. Woolrich, and a "license to use Mr. Woolrich's patent process of magneto-plating for the term of five years" was granted in 1845 to the late Mr. Wm. Carr Hutton, the founder of the Sheffield branch of Messrs. William Hutton & Sons.

Within recent years great improvements have been made in electrical plants as applied to electroplating, dynamos now having taken the place of the old apparatus. The base-metal now used on which to deposit the silver is called "German-silver" or "nickel-silver" and is an alloy of copper, nickel and zinc, grayish white in color and much harder than copper. It is rolled into sheets and afterwards manipulated by stamping into dies, spinning on lathes, hammering by hand, etc. the parts and edges being soldered together by means of a gas and air blowpipe. It is then buffed (polished smooth) with sand and oil upon leather wheels making 2500 to 3000 revolutions per minute, and finally thoroughly cleansed. The articles thus prepared are immersed in a vessel or tank containing a solution of the double cyanide of potassium and silver. The electric current, generated by a dynamo, is then passed through the solution, and the silver is then deposited upon the article in the desired thickness. After removal from the vat, the articles are treated upon the scratch-brush lathe and subsequently polished or burnished with steel tools. The final polishing is accomplished by means of lime or rouge and the plate is then burnished with steel tools, giving employment to large numbers of women and girls.

One of the fundamental differences between the old and new plating processes is that, whereas in Old Sheffield Plate, the base metal had to be covered with silver before it was wrought into shape (an article thus consisting of a number of separately plated pieces joined together and liable to show their individuality after use) an electroplated one is first com-

pletely made up in the base metal (German-silver) after which it receives in all parts a covering of silver of uniform thickness which is renewable as often as required.

Another base metal used for electroplating is Britannia-metal, which is an alloy of tin, antimony and copper and is principally used in the manufacture of tea-pots, jugs, spoons etc. The alloy was introduced about 1769 by James Vickers of Garden Walk, Sheffield, England. Subsequently Mr. James Dixon, the founder of the well known Sheffield firm of silversmiths, James Dixon & Sons of Cornish Place, very largely developed the trade in Britannia-metal. The manufacture of wares in this metal largely superseded that of pewter ware in which previously there had been a very important English trade.

Close-Plating:—Another method of silver plating, known as "close-plating" was also extensively employed in former times, and appears to have been introduced into Sheffield by W. C. Hutton in 1832.

Although now superseded by electroplating, it is still carried on in Sheffield to a limited extent. It was generally used on steel articles, almost all the old snuffers being of steel, close-plated. It was also largely used for fruit-knives and forks. The process consists in first making the article perfectly smooth and clean, and then tinning it by dipping into melted tin. A foil of pure silver, beaten thin and cut into the size of the object was then placed upon it and fitted as perfectly and closely as possible. When the silver foil had been closed upon the steel in every part by careful hammering, a heated soldering iron was passed over the whole of the surface, by which operation the tin again melted and formed a kind of solder between the steel and silver foil. The surface was then polished with a steel burnisher. By this process the finished knife has a good cutting edge and is not acted upon by the acid of the fruit and will last a lifetime.

Sterling-Silver. It is but natural to expect that manufacturers of plated goods would now and again see openings for supplying their customers with silver ones and thus combined trades would arise. The exact date of the introduction of the silversmith is a little uncertain, but probably this would be about 1760, since it is stated in Hunter's "Hallamshire" that prior to that date Henry Tudor and Thomas Leader, both of whom had been apprenticed in London, came to Sheffield to make snuff-boxes and small silver articles that were struck in dies. By the year 1773, the silver industry appears to have grown to some importance, as a petition of several artificers in silver plate in that town and neighborhood of Sheffield, was in that year presented to Parliament, setting forth that: "A manufacture had of late years begun within the town and neighborhood, and was then a very considerable trade, very likely to increase" and asking that an Assay Office should be established in Sheffield. From that time the industry has gradually increased until it has attained its present important position.

In connection with the manufacture of silver wares, the quality of the metal to be used has been fixed by law for centuries. It is well known that silver or gold, when pure, is almost as soft as lead, and articles made of either would be quite unequal to the wear of everyday life. To remedy this defect it is necessary that some other metal should be added to impart a certain amount of hardness, and copper is almost universally employed for this purpose.

By a law passed in 1300, in the reign of Edward I, it is enacted that the legal standard of silver-ware should be 925 parts of silver per 1000. This alloy is known as "standard" or "sterling" silver. Another legal standard for silver-wares also exists, viz., 959 parts of silver per 1000, known as Britannia-silver, but as it is much softer than standard silver it is seldom used. The actual preparation or melting of the standard silver is usually effected in small wind furnaces with natural draught. Many of the larger firms prepare their own alloy, but standard silver is also supplied to the trade by local smelting companies and refiners, several of which have been in existence for over 100 years.

Standard silver is very malleable and ductile, and is well adapted for casting. Owing to its malleability, it lends itself with great facility to the design of the artist and craftsman. It can readily be shaped into vessels of various kinds by means of the hammer, or raised by the process of stamping into objects of almost any desired shape. For the manufacture of silver knife blades, etc. the metal is forged by hammering in a manner similar to that employed for the manufacture of steel blades, by which treatment it acquires a considerable degree of hardness and toughness, and its resistance to wear is considerably in-

creased. Many beautiful examples of the silversmiths' art have been produced by Sheffield firms.

The growth of the silver trade in recent years may perhaps be best indicated by the fact that whereas in the year 1810 the weight of silver marked at the Sheffield Assay Office was under 60,000 ounces, and in 1860 amounted to only about 85,000, at the present time approximately 1,500,000 ounces of silver pass annually through the office. This does not, however, represent the total weight of silver articles manufactured at Sheffield, as a considerable weight is sent to London and elsewhere for hall-marking to meet the wishes of customers. It is interesting also to note that about nine-tenths of the increase shown by these figures has taken place within the last 20 years. At the present time there are between 150 and 200 firms in Sheffield manufacturing sterling-silver wares, electroplate and Britannia-metal.

The importance of the silver industry in Sheffield may be gathered when it is stated that, so far as can be computed roughly, something like 10,000 persons are employed by the various factories or as out-workers. Some firms do everything on their own premises, others have a certain proportion of their work done by outworkers and in some cases a firm procures its goods in the rough and only finishes them. The nature of the silver plating trade allows the employment of a comparatively large number of women and girls Gold wares are also manufactured in Sheffield, and although the number produced annually is comparatively small, the trade is gradually increasing.

Assay Office. The importance of the silver industry is also emphasized by the fact that Sheffield is one of the four cities in England at which an office now exists, authorized by act of Parliament for the assaying and hall-marking of gold and silver wares. With certain exceptions, all gold and silver articles manufactured must be submitted for assay and hall-marking before being exposed for sale.

At the date of the birth of the silver-trade in Sheffield, offices authorized to assay and mark silver and gold wares existed at London, Chester, Exeter and New-Castle-on-Tyne. The establishment of an assay office at Sheffield in 1773 was consequent upon a petition to Parliament on the first of February of that year.

The Act reciting that silversmiths and plate workers in Sheffield were under great difficulties and hardships in the exercise of their trades, for want of assayers in convenient places to assay and "touch" their plate, appointed Sheffield to have an assay office for assaying and marking wrought plate, and incorporated a company entitled "Guardians of the Standard of Wrought Plate Within the Town of Sheffield" with perpetual succession and power to use a common seal. The Guardians appointed by the Act were noblemen and others resident in or within twenty miles of Sheffield. They are thirty in number, and it is enacted that of thes a certain proportion (at the present time not more than one-third, nor less than one-fifth) shall be plate workers. No time was lost after the Act was passed before the company proceeded to business. They met on the 5th. of July, 1773 under the presidency of the Earl of Effingham and appointed officers, etc. The principal officers are four Wardens, the Assay Master, and a law clerk. The regulations of the office are similar to those in force in Birmingham, and are much more precise than those of London. The distinctive City Mark, struck upon all wares assayed in Sheffield is a Crown for silver, and a York rose for gold.

The Assay office, which is situated in Leopold St., is equipped with thoroughly up-to-date appliances. Prior to 1893 all silver assays were made by the old cupellation method, but in that year the Volhard (sulphocyanate) volumetric method was introduced. Power to assay and hall-mark gold wares was granted to the Assay Office authorities in 1904. The method employed for the assay of gold wares is similar in principle to that universally adopted for the assay of ordinary gold bullion, and involves cupellation to remove the base, oxidizable metals, and the inquartation, with subsequent parting in nitric acid to remove the gold.

The wares sent for hall-marking are carefully scraped so as to obtain fair samples of the metal of which they are made, and the samples are subsequently assayed. The Acts provide for the marking, with the authorized marks, known as "hall-marks", such wares as, on trial, are found to be of silver or gold of standard quality, and the breaking up of any found to be worse than standard.

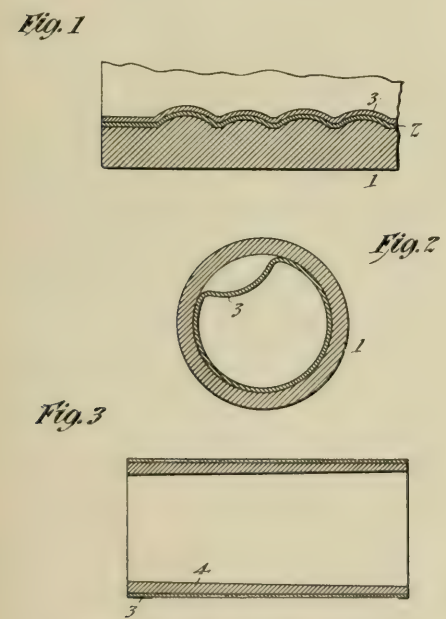
It speaks well for the various Sheffield firms which supply standard silver to the trade, that the average quality of silver which has failed

to "pass the Hall" within the past ten years is below one-half ounce per ten thousand ounces assayed and hall marked.

A New Process of Making Duplicate Phonograph Records by Electroplating.

A new process of making duplicate phonograph records has been patented by Frank L. Dyer of the Edison Phonograph Works of West Orange, N. J. The process is described by the inventor as follows:

The mold 1, of any suitable character, either tubular or of disc form, is provided with the usual record surface as shown. The mold is then placed in a suitable cobalt plating bath, preferably a concentrated solution of cobalt chloride with cobalt anodes and on the record surface is plated an exceedingly thin film or blush of cobalt 2, which may be less than .0001



Method of Making the Record by Plating.

of an inch in thickness. During this plating, the mold is preferably rotated so as to make the plating uniform. The mold is now washed and is then immersed in a solution of copper sulphate, the reaction causing the cobalt to go into the solution and the copper to be deposited as "cement copper" in a minutely granular but slightly adhesive form. Preferably, the immersion is continued only long enough to result in the covering of the cobalt film with a perfect layer of cement copper, so as to leave a part of the cobalt film still intact. If all the cobalt were dissolved in the copper sulphate bath, there might be danger of the electrodeposited film being plated imperfectly at first, since it is deposited under a condition of tension, but it will be understood of course, that if desired, the entire film of cobalt may be reduced to cement copper. Instead of first depositing on the mold a thin blush of cobalt, as explained, any other metal might be used in connection with which substantially the same reactions take place, for instance, iron. Having coated the record surface of the matrix or mold with an excessively thin film of cement copper, as explained, I now electroplate upon such film, a heavier deposit 3, of a suitable metal, upon which the record is to be made. This is preferably nickel, owing to its non-oxidizing properties. Preferably, during the operations which have been described, the matrix or mold, except for its record surface is protected by a coating of varnish or paraffine, or some similar material, so that the plating operations will be confined to the record surface. The shell or disk of nickel or other metal, which has thus been formed (depending, of course, whether the mold is tubular or disk-like) is removed, which can be readily effected, owing to the slightly adhesive character of the film of cement copper. When the mold is tubular, the shell is preferably collapsed, as shown in Fig. 2. Having obtained a shell or disk of electro-plated metal, carrying an accurate copy of the record to be duplicated, it is now supported on a suitable foundation 4, of plaster-of-Paris, or papier maché. It will be understood that in order to facilitate the stripping of the electrodeposited duplicate from the matrix, the matrix with the electroplated deposit in position, may be subjected to a thirty to forty per cent. solution of cyanide of potash, by which the cement copper will be dissolved, so as to entirely free the electrodeposited layer, but ordinarily this is not necessary, since the adhesion of the particles of cement copper is so slight as to permit the electrodeposited layer to be readily stripped from the matrix or mold.

Soft electrodeposits are always produced by the use of a low current density (weak current), while hard deposits result from forcing the deposit by a high current density (strong current).

Kind of Cast-Iron Used in Making Molds.

By Erwin S. Sperry.

In casting brass for rolling, cast-iron molds are used and those who follow the brass business well know that the quality of the iron employed in them has a great influence on their life. The casting of a mold of gray iron seems a simple matter and so it is, but there are few iron founders who use pig-iron adapted for the purpose. The majority of founders make machinery castings in which a hard, close-grained cast-iron is necesary. Such iron does not give very good service in the brass trade for the reason that it is too hard and soon cracks. A good mold should last for a long time and the leading concern in the United States making such molds guarantee them for a year and will cast the date upon them so that the user may keep track of them.

In the casting of ingot metals the same rule applies and although ordinarily gray-iron answers, it is too hard and the molds frequently last but a few days. When the iron is too hard on account of the use of a large amount of scrap, it is often found that the molds will crack the first time the brass is poured into them.

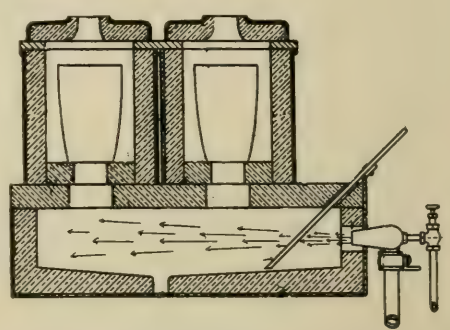
In the brass rolling mill trade, practically one company supplies all the molds for casting the brass and they have done so for years. They have found that in order to produce a good and lasting mold, the quality of the iron must be right. They run special heats on it and cast the molds from nothing else. A mold made by this company gave particularly good service and knowing that the quality of iron used for making molds is not generally appreciated, the following analysis was made of it:

Graphitic Carbon	2.40%
Combined Carbon	0.60%
Silicon	1.50%
Sulphur	0.11%
Manganese	0.46%
Phosphorus	0.29%

The casting made from this iron is quite soft and cuts very freely. This softness is undoubtedly the cause of the long life of the molds. There is no occasion for a strong iron in the molds and softness prevents the cracking when the metal strikes it. Those who desire to make molds for casting brass or other high melting metals, should use an iron of this character as it has been found satisfactory in every way.

A Melting Furnace with a Combustion Chamber.

An improved form of furnace for melting metals has been recently patented by John R. Flaherty of Cincinnati, Ohio (U. S. Patent 1,003,444, Seut. 19, 1911). The essential feature of the patent lies in the use of a combustion chamber underneath the furnace to prevent the flame from striking against the crucible. Oil or gas is employed as the fuel. The furnace is herewith illustrated and is made in the following manner:



Crucible Furnace with Combustion Chamber in the Bottom.

Underneath the furnace is a chamber as shown in the cut and at one side the oil or gas burner enters. The flame strikes against a baffle-rod so as to break it up and scatter it. After striking against this rod, it passes up through the flues in the bottom of the furnace and around the crucibles. The advantage claimed is that the crucible, in which the brass or other metal is melted, is enveloped with flame in an even manner and there is no local injury.

When deposited from a cream of tartar solution, tin has nearly the whiteness of silver. Ordinary brass pins are examples of this kind and are tinned by boiling them in a solution of cream of tartar in contact with block tin. No electric current is used, the electric current necessary for the electrodeposition being generated by the contact of the brass and tin themselves.

The Brightening of Small Metal Articles by Means of the Centrifugal Machine.

In The Brass World, December 1908, page 399, was described a machine for drying out small metal goods by means of centrifugal motion, and at the same time forcing a blast of hot air upon them while they are being rotated. This hot blast serves to brighten the articles and leave them in a uniform and clean condition.

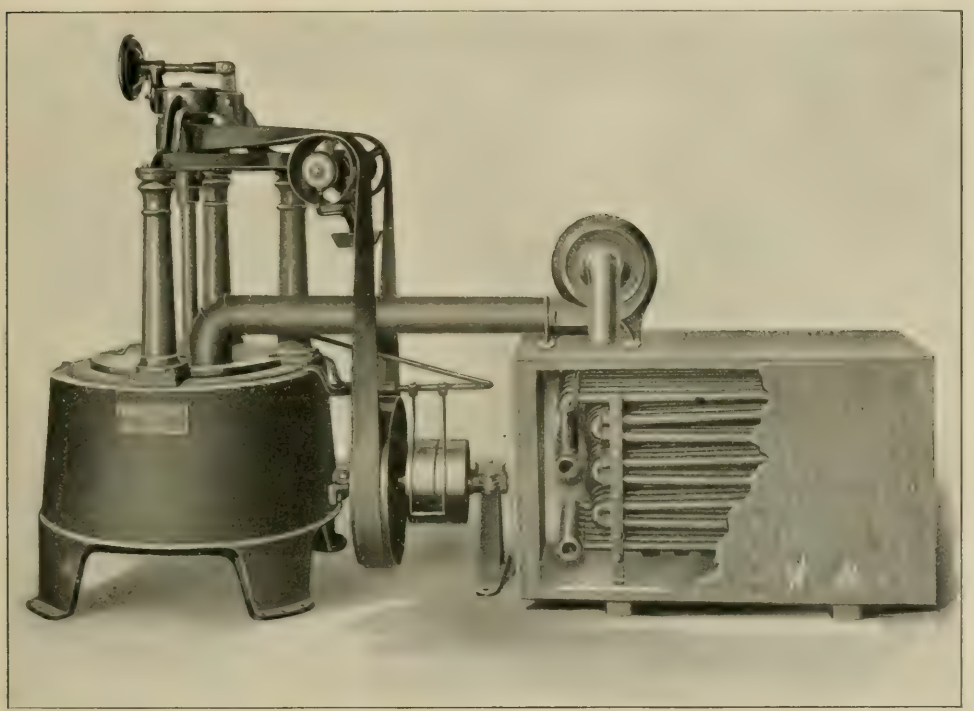


Fig. 1. The Tolhurst Centrifugal Machine with Hot Air Blast for Brightening Small Metal Goods.

Although this machine was invented by F. A. Tolhurst of the Tolhurst Machine Works, of Troy, N. Y., a patent has recently been taken out on it. This patent (1,003,827, Sept 19, 1911, Art of Drying and Polishing) has been granted in the name of F. A. Tolhurst and the machine is now being manufactured by the Tolhurst Machine Works of Troy, N. Y., the well known makers of centrifugal machinery.

It is customary in the manufacture of many kinds of metal articles, as one of the final steps in such manufacture, to dip them into an acid solution to remove the traces of manufacturing, as for instance to remove fire marks, or to clean them from metal dust, oil, dirt accidentally collected, or other foreign or undesirable matter to put them in final commercial condition. Other metal articles are electroplated. In the case of the articles which are acid-dipped, and in the case of those which are electro-plated also, it is necessary that the liquid in which they were immersed be removed quickly and uniformly from all parts of the surface to prevent oxidation, corrosion and stain. It is further necessary to "brighten" these surfaces, that is, to impart to them the uniform lustrous and bright appearance common to the completed commercial articles of these classes. Heretofore such articles have been dried and brightened by being tumbled in barrels, or shaken in sieves, containing hard wood saw-dust. The particles of saw-dust by reason of their porosity absorb the moisture from the surface of the articles, and serve also by a sort of gentle attrition or buffing action to brighten the articles, that is, to give them the lustrous appearance which

constitutes the commercial finish. The work as performed with the saw-dust and attendant apparatus is tedious and laborious, and where conducted on a large scale involves considerable apparatus in the way of tumbling barrels, saw-dust bins, etc., and requires also much manual labor. Furthermore, the saw-dust is constantly deteriorating, as it absorbs the moisture from repeated operations and is therefore uncertain and non-uniform in its action, and is both a troublesome and costly element in the manufacturing work. Furthermore, this operation constitutes a very large proportion of the expense of production, especially where the articles are small and the price thereof low. In the case of threaded articles, the saw-dust has been objectionable, and has deteriorated the commercial value of the product by remaining adherent to the threads.

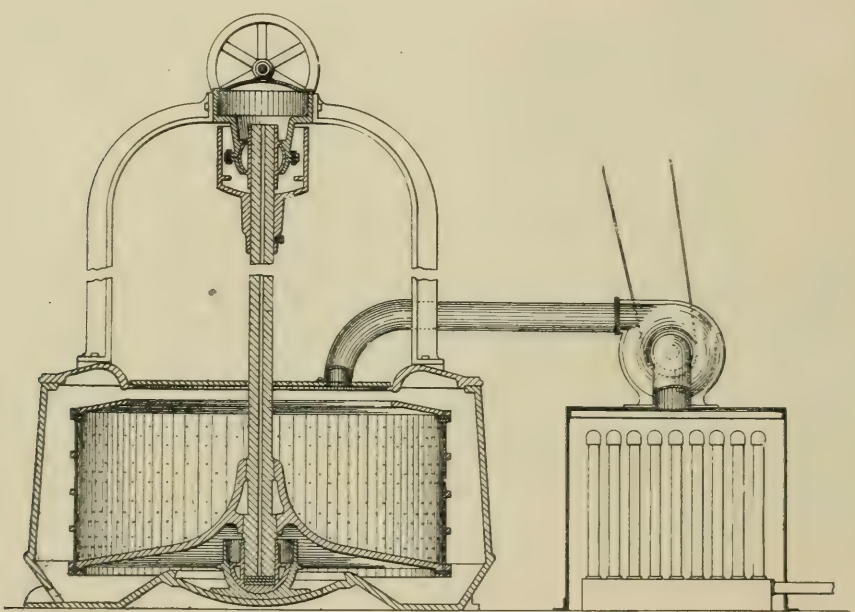


Fig. 2. Detail of the Tolhurst Centrifugal Machine.

The present invention dries and brightens such acid-dipped and electro-plated metal articles with great rapidity, and is capable of acting at one time on exceedingly large quantities of such articles to simultaneously brighten and dry them.

According to the present invention a mass of the metal articles are taken wet from the cleaning or electrolytic bath and are subjected to the action of a blast or current of hot, dry air moving at great velocity, and in accordance with one feature of the invention, the mass of articles is at the same time moved in a transverse direction to the direction of movement of the current of air, and also preferably at a high velocity. The articles are thus dried and at the same time brightened, or rendered lustrous to a very high degree, giving them a pleasing, satisfactory and superior commercial finish. Both the drying and brightening action is accomplished by the action of rapidly moving air currents, and not by any attrition due to movements of the articles in the mass either against or relatively to each other, or against any other substance. In fact with most such articles, it is essential that they be at rest relatively to each other individually, as they would otherwise be scratched and abraded so as to be uncommercial.

The movement of the air and of the mass of articles in transverse directions serves to render the drying and brightening action of the air uniform in all parts of all the articles, notwithstanding intricacy of shape in the articles, and also notwithstanding that the articles may individually be very small and the mass of articles operated upon at one time be relatively very great. This appears to be due to an intense vortex action of the air set up between and around all parts of the massed

articles, whereby all the parts of the articles are reached and acted upon by the violently moving air currents.

A Modification of the Ordinary Sand Molding Process.

A modification of the ordinary process of molding in sand has been patented by Herbert L. Whittemore of Urbana, Ill., and which is rather novel in its method. The reader will understand the process by referring to the sketches, which are herewith shown, and following the various steps.

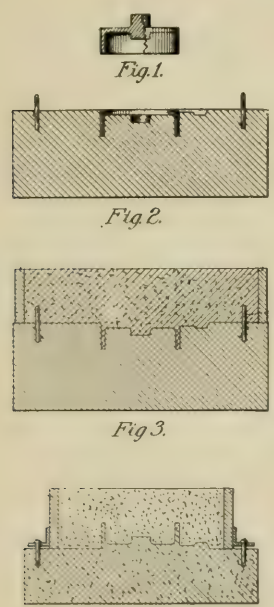


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

The First Stages in Making the Mold.

In accordance with the improved process a form is first made of a suitable plastic material, of which paraffine wax is the best example known. Paraffine is easily melted. It may be readily cut or shaped by means of tools and it hardens at ordinary temperatures so as to maintain the shape which is given to it in the forming process. This wax form thus produced is in the shape of an intaglio of the article to be cast. The surface of the paraffine in which the intaglio is formed is preferably conformed also to duplicate the gate and parting surface of the mold which ultimately is to be made from the finished pattern. When the form has been completed, hydraulic cement, or concrete of hydraulic cement is placed in the intaglio of the article to be cast and of the gate thus to make a pattern not only of the article to be cast but preferably also of the gate and parting surface of the mold. When the concrete sets or hardens,

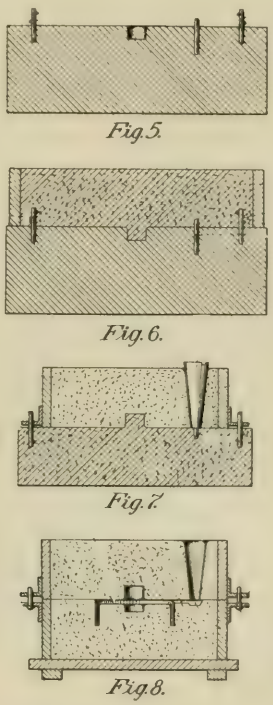


Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

The Second Stages in Making the Mold.

there results a hard durable pattern which is a reverse of the sand mold into which the molten metal is to be poured in casting. The pattern duplicates not only the article to be cast but also the gate or gates leading from the sprues or risers and also the parting surface of the mold.

When the pattern has hardened sufficiently it is removed from the form and by means of suitable registering devices, such as dowels and dowel pins, it is made to occupy the desired position in the flask into which the sand is tamped to form the sand mold. If the article to be cast lies entirely upon one side of the parting surface, an intaglio of the whole of the article to be cast will be cut in one form. The pattern in this case having been brought into register with the drag of the flask will serve to form the sand which is

then tamped into the drag to conform with the article to be cast except that the parting surface of the cope must have a plane surface to come into juxtaposition with the parting surface of the sand of the drag, and this plane surface may be formed against the plane molding board or against the plane pattern of concrete as may be preferred. If on the other hand the article to be cast lies partly on either side of the parting surface, a separate pattern is required for each portion of the mold. In a two-part mold a second portion will be made in the manner above described with respect to the portion of the pattern which is used in the drag. This second pattern will be cast in concrete from a wax form which is cut into an intaglio of the portion of the article to be cast which extends above the parting surface of the mold and thus into the cope of the flask. The cope pattern is brought into register with the cope of the flask in the same way that the other portion of the pattern is brought into register with the drag. Molding sand is then tamped into the cope to form the cope portion of the mold. The two portions of the mold when completed are brought into register by means of dowels or other registering devices to form a complete sand mold into which the molten metal to be cast is poured.

Testing Voltmeters and Ammeters.

Now that electrical measuring instruments are widely used in the plating industry, a word in regard to testing them may be of value There are many kinds of instruments now sold; some are good and some are cheap. The cheap ones are those which will give the most trouble.

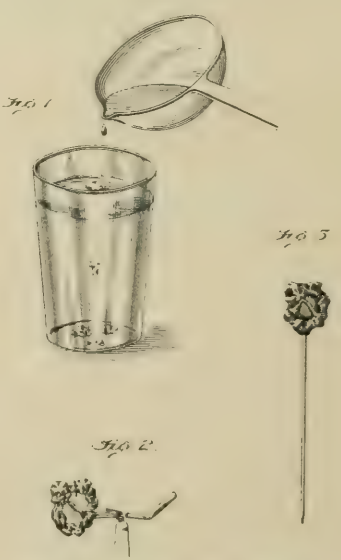
In each instrument there is a permanent magnet. This magnet, particularly in the cheap instruments, gradually loses its magnetic power so that its action is not the same after ten years as it was at the beginning when the instrument was made. This means that the readings may be subject to error after the instrument has been in use for a number of years.

The best forms of measuring instruments are provided with magnets made of special steel which retain their magnetism for a long period of time without appreciable change. The cheaper form of instruments do not change much to be sure, but it has been found enough to alter the readings and mislead the plater. In one instance an old instrument was tested and it was found to give practically twice the readings it should. The magnetism in the permanent magnet had nearly disappeared.

It is advisable, whenever possible, to test the old instruments by comparing them with those known to be correct. When this is done some surprising things will be found. In one case which we have in mind, a plater claimed he was using so high a voltage that it seemed almost incredible; but investigation showed that he was honest in his readings of the voltmeter but the instrument had become quite inaccurate in the course of time. After five years or more instruments should be compared with those of known accuracy. They usually remain accurate for this length of time, even though of the cheapest character.

Producing Articles of Jewelry.

A method of producing articles of jewelry has recently been patented by C. A. Mealy and Russell L. Parcell of Baltimore, Md. The process consists of melting gold or silver and granulating it by pouring it in water. This



Method of Making the Jewelry.

produces irregular shaped pieces of metal as shown in the illustration. These pieces may then be soldered together in the form of scarf-pins etc., and, it is stated, the soldering

(hard) will cause a discoloration of the portion near the solder while the other portions remain in their original color. A variegated article is then produced, as far as the color is concerned, which has a pleasing appearance.

Sugar as a Carbonaceous Covering in Melting Silver.

In the melting of sterling-silver, some covering is necessary in order to protect the molten metal from the action of the atmosphere. Unless this is done, the silver will absorb gases during the melting and will then expel them again during the cooling of the metal in the mold, producing blow holes or pin holes.

As a covering for the silver, charcoal has been found excellent as it supplies a reducing action which is quite beneficial to the silver, and at the same time it contains no sulphur or other deleterious elements which would injure it. Charcoal has been extensively used for the purpose and is excellent, but it has not proved quite satisfactory in the case of gas or oil furnaces. The charcoal, being quite light, is readily blown away or off from the surface of the silver when the melting is taking place on account of the blast, and, therefore, the silver is exposed to the air and products of combustion. Charcoal, accordingly, is not quite satisfactory in such instances.

Sugar has proved quite satisfactory as a covering in the melting of silver. When applied to the surface of the molten metal, it immediately carbonizes and forms a solid, hard mass that is not disturbed by the blast. The molten silver, therefore, is protected by the covering in the necessary manner. It is a well known chemical fact that the purest form of carbon is produced when sugar is heated so that as far as purity of this carbonaceous covering is concerned, there is nothing more to be desired.

The value of sugar as a covering in the melting of silver, therefore, lies in the fact that it forms a layer of pure carbon when heated and which masses together in a solid cake which is not readily blown off by the blast of gas or oil. While sugar is expensive compared with charcoal, its cost is not sufficient to prevent its use when the results are taken into consideration.

Excel-All Dynamos.

The new line of plating and electro-typing dynamos recently placed upon the market by The Bennett-O'Connell Company of Chicago, Ill., contains some new features of merit as well as some of the latest features in electrical engineering.

The main feature of this dynamo lies in the brush and brush holder, which is a radical departure in plating dynamo construction. They have adopted what is known as a radial type of brush holder and brush, which is shown by

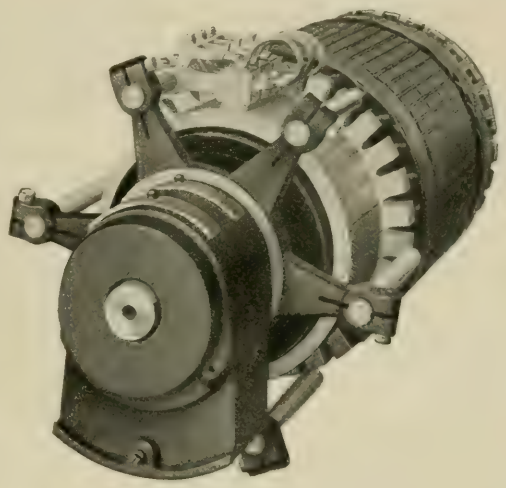


Fig. 1. The Excel-All Dynamo.

the accompanying cuts and which allows the brush to rest radially upon the commutator, the brush being actuated by a tension finger. This keeps the brush in contact with the commutator at all times, thereby overcoming the great objection to the old type of copper leaf or woven wire gauze brushes in that when they wear down the brush gradually shifts back off the point of commutation, which, heretofore, has required considerable time and trouble in retrimming and resetting of the brushes. This is entirely overcome by their radial brush holder. The accompanying cuts will give the reader a practical view of this holder and brush and its position on the commutator as used on their line of dynamos.

The brush used in connection with this brush holder is a composition brush with a very high conductivity, which is guaranteed to commutate 150 amperes per square inch of

contact. This brush requires no lubrication on the commutator whatever, neither does it require any retrimming or resetting, which brings this line of dynamos up to the standard practices of standard lighting dynamos and power motors.

In general design they have adopted the well known round type of dynamo frame, being made of cast iron with steel blocks cast, welded and bolted into the same.

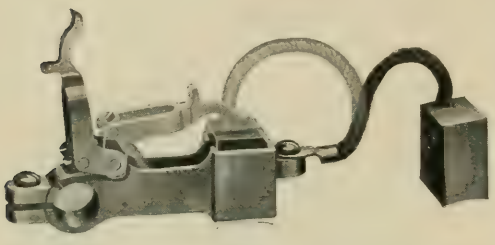


Fig. 2. Method of Making the Brush Holder.

The armatures are bar wound, thoroughly ventilated radially and longitudinally. The commutators are made of tempered copper, thoroughly insulated with mica insulations and are also ventilated parallel with the shaft. In fact, the combined outfit is so designed to take care of the heavy duty that plating dynamos are called upon to perform.

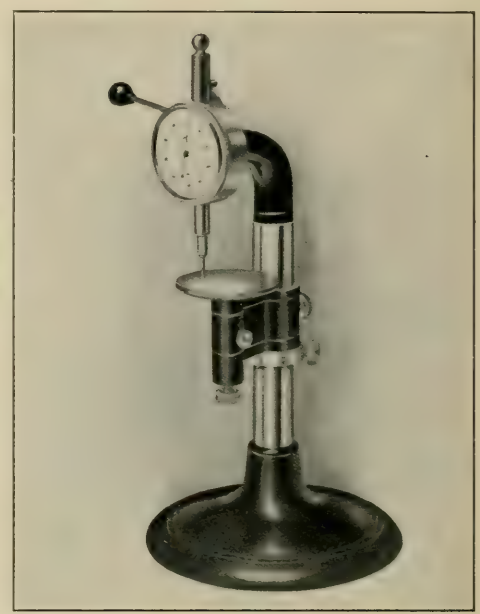
These dynamos are guaranteed to have a rise in temperature not to exceed that allowed by electrical engineers for standard dynamos and motors after a full load run of ten hours. This brings this line of dynamos up to every modern practice in standard dynamo and motor building.

These dynamos are built in sizes from 150 to 3500 amperes and are either belted or motor driven, shunt or compound wound.

Silver plating was the first form of electroplating commercially used and was first carried out in a commercial way by Dr. John Wright of Lincolnshire, England. He discovered that a cyanide silver solution was capable of giving a good deposit. He afterwards sold his process to the Elkingtons who patented it. It has been stated that the patent was legally void for the reason that the patentees were not the actual inventors as the law requires they should be.

A New Form of Micrometer Gauge.

A new form of micrometer gauge has recently been placed on the market by the B. C. Ames Company of Waltham, Mass., and which is one of the most accurate and delicate



New Form of Micrometer Gauge.

instruments yet produced. The gauge is made in several shapes, but one of the most convenient forms is the upright design herewith illustrated.

The gauge is automatic so that the "feel" of different individuals that is necessary in measuring with the ordinary micrometer is absent. To measure an article, the lever is pressed back by the finger and the jaw allowed to fall lightly on the surface. The dial is then read off. Slipping of the finger will not injure the gauge in any way. Measurements up to 1¾ inches may be made, as well as those down to 0.001 of an inch. The readings may be made to a ten thousandth of an inch

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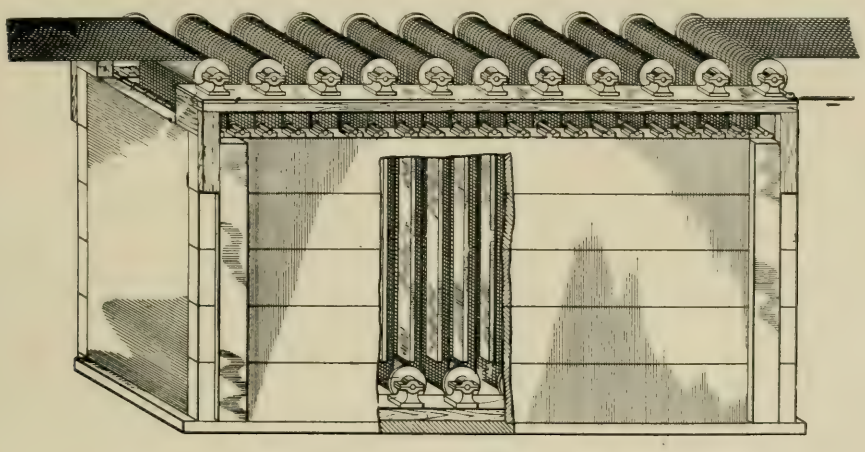
The production of a soft nickel deposit demands that the current density shall be low (a weak current). A strong current means a hard deposit.

A Method of Electroplating Wire Cloth.

The electroplating of wire cloth is now extensively carried out, not only for the rust proofing (electrogalvanizing is employed for this) but for the production of an ornamental finish. The plating of the cloth without a special apparatus is difficult. Francis J. Root of the New York Wire Cloth Co. has recently patented an appliance for plating the cloth which obviates most of the difficulties previously experienced.



Manner of Electroplating the Wire Cloth.

The cloth is fed to the plating tank in a continuous length. The anodes hang in the solution from rods across the tank and the cloth in passing through travels on each side so that the distance from the cloth to the anode surface is always the same. In the bottom of the tank is a series of rolls over which the cloth passes and to which it again rises to the top of the tank over other rolls. The cathode connection is made on the top roll so that as the cloth passes along it is always in contact. These rolls also serve to break and dislodge any air or gas bubbles that are so troublesome in the ordinary plating of wire cloth.

The process, the inventor states, is particularly applicable to the bronze plating of wire cloth to be used for window screens.

Lead is one of the most easily corroded of the common metals and copper alloys containing it corrode more readily than those free from it.

Decline in the Use of Britannia-Metal in England.

The production of britannia metal was formerly an important industry at Birmingham and Sheffield. It was used especially in the manufacture of coffee and tea services and to a limited extent in the production of spoons and forks, but is not used for music plates. The proper composition of a good quality of britannia metal is 90 per cent tin, 8 per cent antimony, and 2 per cent copper, and when tin sold at $300 to $350 per ton the metal was cheap and filled the place now occupied by German silver. Since, however, the price of tin has risen to $950 or more per ton the value of britannia metal has so increased that it is more economical to use German silver, though the cost of the manufacture of German silver is much higher. As an industry it may be said that the manufacture of britannia metal has practically died out. It is still used to some extent for the manufacture of hot-water jugs, coffee and tea pots, sugar basins, soup tureens, dish covers, soap boxes, etc. It is also used to a limited extent when applied to the cheapest kinds of brushes, mirrors, etc., by the electroplating process.—*Daily Consular Report.*

The so-called Sheffield-plate was first produced by Thomas Bolsover in 1742. He was a cutler of Sheffield, England and the name is thus derived.

Questions and Answers.

QUESTION No. 1044. Can a brass solution be run in a lead lined tank? We are making up a new solution and would use lead if satisfactory.

Answer. Lead is slightly soluble in a cyanide solution and for this reason it is not to be recommended. You will find an iron or steel tank the best and they are extensively used. In place of this a wood tank can be used and this also will be found very satisfactory although its life is shorter than that of the iron or steel tank. A good steel tank will last a life-time.

QUESTION No. 1046. Can silver be plated on steel and then the whole heated to the melting point of the silver to fuse it on? I have heard that nickel is deposited on the Edison storage battery in this manner and wish to use the same process for silver on a certain kind of article if it can be done?

Answer. You will be able to fuse the silver on the steel in the manner you suggest, but it will be necessary to heat the article after silver plating, in an atmosphere of hyrdogen gas or ordinary illuminating gas in order to prevent the silver from oxidizing and becoming covered with blisters. Edison heats the nickel plated steel in hydrogen gas and obtains a satisfactory union of the nickel and steel.

QUESTION No. 1047. I have noticed in THE BRASS WORLD that a small quantity, given as about 0.005% of aluminum in a galvanizing bath will produce a brighter and cleaner, as well as smoother zinc coating on iron or steel goods. I have tried it on two or three occasions, putting in the aluminum as a 95% zinc and 5% aluminum alloy. Each time I found a layer of aluminum on the top of the zinc and the galvanized goods were rough and had patches on them. The galvanizing kettle stood at 800°-850° Fahrenheit by the pyrometer. I should be pleased to be enlightened on the matter as it would appear from my results that the aluminum is unsatisfactory in a galvanizing bath.

Answer. Practically every galvanizer now uses aluminum in his galvanizing kettle and there is no question about its great value. You probably did not mix the aluminum with the zinc completely and worst of all, your kettle seems to be covered with a layer of dross which adheres to the goods. Throw some sal-ammoniac on the surface of the molten zinc after adding the aluminum, then skim and repeat until a clear zinc surface has been obtained. When this has been done you will have no further trouble.

QUESTION No. 1049. In melting brass in crucibles should the coal or coke be charged up to the top of the crucible? We have heard that the crucible will last longer if this is done.

Answer. You will find your crucibles will last a longer number of heats if the coal or coke is charged nearly to the top of the crucible as it prevents the air from having access to the graphite in the crucible mixture and burning it away.

QUESTION No. 1050. What is the cause of the cracking of brass during rolling into sheet. We use the best electrolytic copper and "brass special" spelter. While we had no trouble until recently, within the last few days the brass has begun to crack on the edges when we "break-down" the cast bar. We have, so far, been unable to locate the cause and would like your assistance on the matter.

Answer. The cracking of brass during rolling may be caused by a number of different conditions. They are:

1. Too much antimony, bismuth, or arsenic in the copper.
2. Too much lead in the brass mixture.
3. Brass mixture too hard (i. e. too much spelter in it or too "high.")
4. Too heavy a "pinch" in breaking down, or too much reduction before annealing.
5. Oxide of copper or oxide of zinc in the brass (or both).

If you are using a good grade of copper and spelter, as you say you are, it is probable that your difficulty is caused by the presence of oxide in the brass. This is a very common difficulty and the oxide, being a non-metallic element, acts like so much dirt and causes the metal to part during the rolling. The reason for the oxide in the brass is the oxidation of the copper during the melting. This may be (and almost invariably is) produced by not keeping the copper well covered with charcoal during the melting. When the zinc is introduced, the oxide of copper is reduced, forming oxide of zinc which causes the cast metal to be full of little, fine particles which prevent the cohesion of the brass itself. When pressure is put upon it, as it is in rolling, the brass cracks. The remedy is to keep your copper completely covered at all times with charcoal, and particularly to avoid overheating the copper during melting.

QUESTION No. 1051. Would sterling-silver made with any other alloy except copper be called sterling-silver, and would it conflict with the laws governing the manufacture of sterling-silver wares? We desire to use or try other alloys but are not fully conversant with the laws.

Answer. There is nothing in the laws of the various states which regulate the sale of sterling-silver wares, nor custom, which will prevent any alloy from being used in place of copper. The law and custom require only that the sterling-silver shall contain 925 parts of silver in 1000 parts, and makes no stipulations about the alloy. As long as you do not have less than 925 parts of silver in the goods, you can use whatever alloy you please. If the sterling-silver is over 925 parts in 1000 it makes no difference either; but manufacturers endeavor to maintain practically this propor-

tion for the reason that if a greater proportion of silver is present, the sterling-silver becomes more costly, and at the same time softer. Too much softness is undesirable for many grades of goods, such as flat-ware.

QUESTION No. 1052. How can aluminum be cast upon an iron pipe and what aluminum mixture should be used? We have tried to cast it upon the pipe, but it does not lie quietly upon the iron when cast and the casting is then imperfect. Please inform us the correct method of procedure.

Answer. While aluminum may be cast upon iron in some instances, in others it will crack on account of the excessive shrinkage. Whether it will do this or not will depend upon the character and shape of the casting. You should, by all means, use an aluminum and copper mixture as any of the aluminum mixtures containing zinc will be more apt to crack. Use 93 lbs. of aluminum and 7 lbs. of copper. The iron pipe should be cleaned from scale and then heated red hot and allowed to *cool.* The object is to burn off all the grease, oil and foreign matter so that when the metal strikes the iron there will be no gas formed. Do not place the pipe in the mold while hot, but allow it to cool as otherwise it would cause moisture to start from the mold and settle upon it. If the iron has been heated in this manner and you use the aluminum and copper mixture, you should be able to cast ordinary shapes upon the pipe.

QUESTION No. 1053. We make a self-closing basin-cock of brass and nickel plate it. We are having considerable trouble with its sticking after plating. When it comes out the plating bath, we put it in hot water and hold it there for a considerable time, but that does not seem to help it any. We also tried cold water with the same result. We have no grease in them and thought perhaps the electric current might possibly have something to do with it. Can you suggest anything which will prevent the sticking?

Answer. Your difficulty is undoubtedly that the plating solution enters the interior of the cock and you do not remove it completely by rinsing. Drying on, therefore, causes the parts to stick. We can suggest nothing else other than a long soaking in water, preferably hot. If you are unable to overcome the difficulty by this treatment, you will have to nickel plate the parts separately and then assemble them afterwards.

QUESTION No. 1054. In making sheet German-silver, what effect does carbon have upon the metal? I have heard that carbon hardens the metal so that it cracks.

Answer. The effect of carbon on nickel is similar to that of steel in that it hardens it. Nickel takes up carbon readily in melting when in contact with carbonaceous materials such as graphite or charcoal. This is why German-silver, when melted over many times, becomes hard and cracks in rolling. When carbon is present in German-silver to any extent, even a slight one, it causes it to crack in rolling or working. It has been stated by an authority that about 0.04% of carbon in German-silver is the limit if good working metal is desired.

QUESTION No. 1056. What is the usual method of making phosphor-copper?

Answer. Phosphor-copper is made in the same manner as phosphor-tin, by plunging sticks of yellow phosphorus into the molten metal. For this purpose a phosphorizer is used. It consists of a bell-shaped contrivance made of graphite crucible material supplied with an iron rod for a handle. All crucible manufacturers make it. The phosphorus is placed in it, the mouth stopped by a piece of paper and the whole then plunged down into the molten copper. As a violent action takes place, the operator should be protected from the danger which follows. Those who use small quantities of phosphor-copper will find it more expeditious to purchase it on account of the danger in making it, and only those familiar with the method of handling phosphorus should undertake it.

QUESTION No. 1060. We are obliged to make some brass castings which must be strong and hard enough so that they will not bend under the ordinary strain. Ordinary 2 and 1 brass is too soft and we are unable to use composition or tin on account of the color which must be that of yellow brass. Manganese-bronze, while sufficiently strong is too red. Is there any method of strengthening or hardening ordinary yellow brass for our purpose?

Answer. You can always harden yellow brass by the addition of tin without changing the color in any way. You will find the following what you want:

Copper	70 lbs.
Zinc	28 lbs.
Tin	2 lbs.
Aluminum	¼ lb.

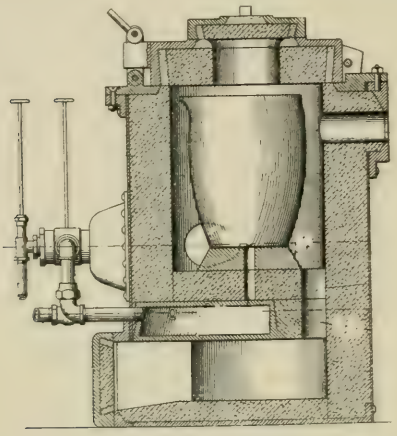
If you are unable to use aluminum in your brass, on account of the character of the castings (plumbers' brass goods or similar work) you can leave it out as the mixture is as strong without it; but the aluminum will assist you in obtaining good, sound castings.

QUESTION No. 1062. In the tinning of nickel steel wire we are experiencing some difficulty with the tin. The wire is first cleaned and then drawn through a chloride of zinc solution, after which it enters the tinning kettle. The tin has been working perfectly up to the last attempt, and we do not find that the tin crystallizes into a shot-like form and does not adhere to the wire. The metal is also very difficult to keep melted. A sample of the tin is sent to show its condition. Why should the tin act in this manner when the last time it worked all right?

Answer. The difficulty seems to be that the tin has become thick through the absorption of oxide. "Thick-tin" is what it is called in the trade. You can undoubtedly reduce the oxide by the use of a little phosphor-tin. Add about 2 or 3 oz. of phosphor-tin (5%) to each 100 lbs. of the tin and you will find that it will liquefy. The phosphorus in the phosphor-tin reduces the oxide.

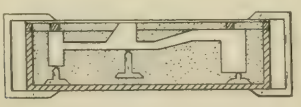
Patent Abstracts.

1,001,696, Aug. 29, 1911. CRUCIBLE FURNACE. Edward H. Schwartz of Chicago, Ill. Assignor to Kroeschell Bros. Co., of the same city. An oil or gas burning crucible furnace in which the flame is given a rotary motion inside of it. The present in-



vention is an improvement on the furnace patented on Feb. 2, 1909 and the improvement consists in the use of a flue for carrying off the gases of combustion. These were formerly allowed to escape through the cover, but a separate flue is used. Less waste and oxidation of the metal are claimed for the furnace.

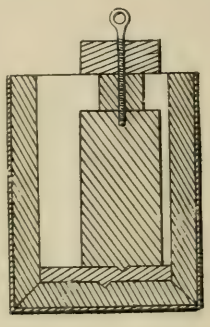
1,003,722, Sept. 19, 1911. MOLD. Albin Eckhardt of San Francisco, Cal. A method of casting metals in sand. The application is for pieces of a long and thin nature or those of complicated shape that are apt to shrink



unevenly in cooling. A special form of chill is placed in the mold so that the casting is cooled locally and warping or uneven shrinkage avoided.

1,003,549, Sept. 19, 1911. FLASK-BAR. John Tuohy of Black Diamond, Cal. A flask bar so constructed that it may be set on the flask without the use of bolts or nails and may be removed at will. Wedge shaped grooved fingers are set in the sides of the flask and the flask-bar forced into them. It is easily removed by driving out with a hammer.

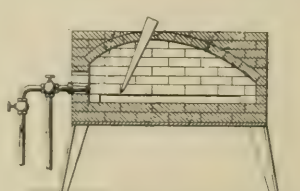
1,001,669, Aug. 29, 1911. COMPOUND METAL BODY AND PROCESS OF MAKING SAME. John Ferreol Monnot of New York City. Assignor to the Duplex Metals Co., of the same city. A process of making a compound metal ingot for rolling into sheet



or drawing into wire. The process is applied more particularly to the manufacture of silver coated steel. The steel core or base is given a coating of copper, then a flash of silver by electrodeposition and finally a layer of silver, after which it is rolled. The use of the metal for household utensils is advocated.

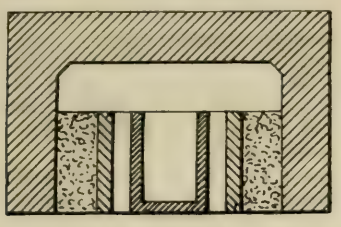
1,001,770, Aug. 29, 1911. PROCESS FOR MANUFACTURE OF METAL BANDS, WIRE ETC., FROM ELECTROLYTIC IRON. Wilhelm Pfanhauser of Leipzig, Germany. The iron is deposited electrolytically from any solution (solution not claimed) and then rolled, after which it is annealed. Such thin iron is to be used in electrical work, such as in the manufacture of generators, motors, etc. The feature of the patent lies in the rolling and the annealing.

1,003,522, Sept. 19, 1911. HYDROCARBON FURNACE. John C. Scrivener of Madison, Ill. An oil furnace for heating metals for



forging, rolling or stamping. The feature of the furnace lies in the use of a baffle rod to break up the flame and disperse it so that the metal is heated evenly.

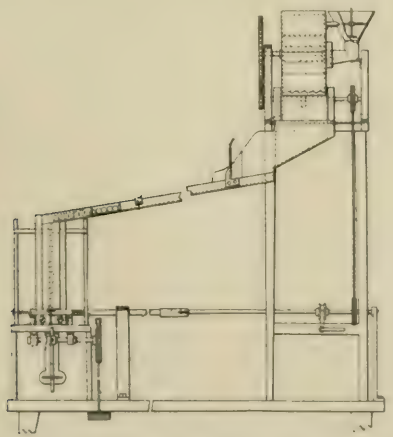
1,003,789, Sept. 19, 1911. CONTINUOUSLY OPERATING HIGH-TEMPERATURE RESISTANCE FURNACE. Victor Popp and Adolphe Minet of Paris, France. A high temperature resistance furnace with a tank



in the middle of it. A portion of the furnace is made of carborundum. The construction of the furnace so as to obtain the desired resistance of the resistance material is the essential feature.

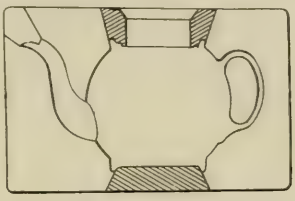
1,002,349, Sept. 5, 1911. LUBRICATING MATERIAL AND METHOD OF MANUFACTURING THE SAME. Henry P. White of Kalamazoo, Mich. Graphite or other lubricating material is mixed with crumpled, thin sheet metal of a soft nature, such as babbitt-metal, and the whole used for packing valve-stems and similar places where a metallic packing can be used. After squeezing down the packing becomes more or less solid.

1,003,218, Sept. 12, 1911. BUTTON BURNISHING MACHINE. John Toland of Boston, Mass. A machine for automatically burnishing buttons of metal, either the whole



surface of the raised letters or designs on it. The machine is so designed that the buttons or button blanks are automatically fed to the burnisher in the position necessary for the burnishing.

1,002,258, Sept. 5, 1911. APPLIANCE FOR PRODUCING ARTICLES BY ELECTRO-DEPOSITION. Frank Iorns Gibbs, of Birmingham, England. The process consists in

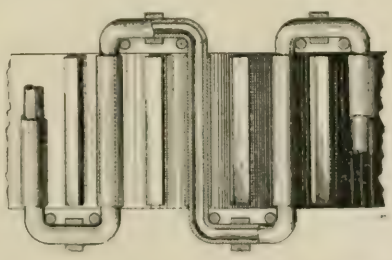


depositing metal, in the form of hollow-ware or other ornamental shape, upon glazed earthenware. When a suitable thickness has been obtained, the whole is stripped, leaving a polished and smooth surface.

1,003,806, Sept. 19, 1911. ARTICLE COMPOSED OF TITANIUM AND NICKEL. Auguste J. Rossi of Niagara Falls, N. Y. Assignor to the Titanium Alloy Co. of Niagara Falls and New York City. The process is upon the method of making the alloy of titanium and nickel. A mixture of titanium oxide and aluminum is melted with metallic nickel to a temperature at which the reaction occurs when the titanium is reduced and alloys with the nickel.

1,003,837, Sept. 19, 1911. MOLD FOR USE IN CASTING ROLLER BEARING CAGES. Bruce Clark White of Woonsocket, R. I. Assignor to the Price-Campbell Cotton Picker Corporation of Wilmington, Del. An iron mold for casting the brass or bronze cages used for holding the rollers of a roller bearing. The mold is made so that the cage is cast solid without the use of a core.

1,003,799, Sept. 19, 1911. PROCESS FOR THE ELECTROLYTIC DEPOSIT OF METALS. Armin Rodeck of Milan, Italy. The process is applied to the manufacture of



tubes or sheets of metal electrolytically and the claim of the patent is upon the shape of the anode.

Trade Items.

A new brass foundry is being erected by J. W. Buckley in Dalton, Mass., for the manufacture of brass, bronze and aluminum castings.

The Ohmer Fare Register Co., of Cleveland, Ohio, manufacturers of fare registers, have acquired a site of over four acres on the Big Four R. R. and a five story building, 50 x 240 feet is to be erected upon it. The plant will be near that of the Ohio Rake Works.

The new plant of the Art Brass & Fixture Mfg. Co., at McKees Rocks, Pa., is now in operation and goods are being turned out. The line of products includes combination gas and electric fixtures, art brass specialties, and similar sheet metal goods. The principal office is in Pittsburgh.

The plant of the American Electric Fuse Company at Muskegon, Mich., is to be sold at a receiver's sale before November 1st.

The United Brass & Foundry Company has been incorporated in Detroit, Mich., with a capital stock of $10,000. Thomas Walburn, M. B. Walburn and William Brabant are the principal stockholders.

C. W. Leavitt & Co., 30 Church St., New York City, the well known importers of pure metallic magnesium, announce that European Works have found magnesium of great value as a de-oxidizing agent in the manufacture of britannia-metal, solder and other tin mixtures. The magnesium is introduced in the form of a magnesium-tin alloy containing from 10 to 20 per-cent of magnesium and the balance tin.

H. D. Phelps of Ansonia, Conn., the well known brass founder and brass goods manufacturer, has increased his plant by the purchase of the entire brass foundry equipment and business conducted by E. H. Wirtemberg of Ansonia, and known as the Ansonia Brass Foundry. This plant had excellent equipment for making heavy brass castings and Mr. Phelps is now in a position to serve the trade in all kinds of heavy brass, bronze and aluminum work, as well as small brass work of all kinds.

The New Haven Sand Blast Co., 47 Orange St., New Haven, Conn., have now had their "Selfcontained" sand-blast rolling barrel on the market a sufficient length of time to thoroughly demonstrate its exceptionally valuable features and its great assistance to the manufacturer of metal goods in reducing costs. This barrel is used for cleaning all kinds of castings, iron, steel, brass, bronze of aluminum, and plain or complicated. It is equally as efficacious on forgings. It is the only method known of treating quantities of work by means of the sand blast. The articles are placed in the barrel and the door closed. The sand blast does the rest. A large number of Connecticut concerns are now using the barrel with great success for a large variety of work.

The Utica Fixture Co. of Utica, N. Y., manufacturers of gas fixtures and also brass founders, are to build an addition to their machine shop. This addition is to be 24 x 100 feet.

The Jackson Ornamental Iron and Bronze Works, which was recently incorporated in Jackson, Tenn., with a capital stock of $25,000 is erecting a factory 60 x 150 feet. Bank and office metal work, elevator enclosures etc., are to be manufactured.

The new plant of the Hall-Miller Company at Marinette, Wis., is now in operation and manufactured goods are being turned out. This company was formerly of Chicago and manufacture surgical instruments of steel and German-silver. Press work is extensively used in their manufacture.

The plant, consisting of the land and buildings, of the Frost Mfg. Co., of Kenosha, Wis., manufacturers of plumbers' brass goods, has been sold to the Chicago Brass Co., of that city, manufacturers of rolled brass. A new plant is to be built by the Frost Mfg. Co., and the Chicago Brass Co., will extend its own plant.

The Lamson Consolidated Store Service Co., of Lowell, Mass., manufacturers of store-service, conveyors, cash-carriers, etc., are going to erect a new factory at their present plant. This building will be 120 feet long and 50 feet wide, four stories high. It will be constructed of concrete and the cost will be about $40,000. This company operate a brass foundry and carry on electroplating.

C. F. Mossman, 706 Laurel Ave., Bridgeport, Conn., designer and modeler, will supply designs for all classes of art metal goods, such as soft metals, ornamental brass castings silverware, britannia-ware, etc. He will also make the model from the design ready for making the mold or pattern. Manufacturers who desire artistic designs produced should correspond with him. He has been connected with one of the largest manufacturers of this line of work until recently, when he started in business for himself.

The Bridgeport Testing Laboratory of Bridgeport, Conn., make a specialty of the analysis of the brasses, bronzes and other non-ferrous alloys, and state that reports are rendered the same day as the sample is received. All kinds of industrial products are tested and analyzed. Pyrometrical tests, the determination of the tensile strength of metals, and the analysis of coal, coke and fuel-oil are matters for which special equipment is had. The laboratory is in charge of H. T. Leavenworth who, for a number of years was associated with the Crane Co., as chemist, and all work is given his personal attention. The opportunity for quoting is desired. The laboratory is now located on Poplar St., but will be moved within a short time to 1119 Broad St.

The Waterous Engine Works Co., of Brantford, Ont. Canada, manufacturers of engines and steam-metal valves, as well as brass founders, are to build an addition to their plant at a cost of $60,000.

The Veeder Mfg. Co. of Hartford, Conn., manufacturers of odometers, cyclometers and speedometers, as well as die castings, is building an addition to its plant which will practically double its size.

An addition to the factory of E. H. Titchener & Co., of Binghampton, N. Y., is being made. This company manufacturers staples, small nails, tacks and various small wire goods.

A new factory, 42 x 160 feet, is being erected by the United States Cashier Company at Kenton, Oregon and which is to be of fire-proof construction. This company manufactures computing machines and the president and general-manager is Frank Menefee.

The Newark Art Foundry Co., has been started at 30 Franklin St., Newark, N. J., and will carry on the business formerly conducted by Ernest J. Vatier. The manufacture of fine castings in all metals, particularly gold and silver will be continued as in the past.

A new rolling mill has been installed in the works of Shimer, McGlynn & Co., of Philadelphia, Pa., who started a brass rolling mill a short time ago. This new mill consists of two stands of rolls, one 20 x 36 in. and the other 20 x 30. The rolls are both motor driven. The mill is to be used for the cold rolling of Monel-metal of which the company are making a specialty.

The Virden Mfg. Co., of Cleveland, Ohio, manufacturers of brass and other metal goods, as well as electroplaters, have moved to their new factory 6011 Longfellow Ave. and 2166 Ashland Road. This new factory is the largest one of its kind in the United States and will give this company the much needed facilities for carrying on their business on a larger scale.

The Mason Regulator Co., Dorchester, Mass., manufacturers of steam goods, is erecting a new brass foundry in that place. This foundry will be of fire-proof construction. Fire-proof vaults will also be used for pattern storage. The brass melting furnaces will be set level with the floor. The main office of the company is at 158 Summer St., Boston, Mass.

John C. Culbert of Pawtucket, R. I., has resigned as president of the John C. Culbert Co., of that city, scrap metal dealers and refiners, and has formed a new company called the Pawtucket Smelting and Refining Works. The company is incorporated under the laws of Rhode Island with a capital stock of $100,000 and John C. Culbert is treasurer and general manager of it. They announce that "spot-cash" will be paid for all kinds of metals, sweeps, grindings, drosses and residues, and that a specialty will also be made of gold and silver sweeps.

The Rochester Stamping Co., Rochester, N. Y., manufacturers of hollow-ware, are to erect a four story addition, 60 x 109 feet, The company is located on Jones St.

An extensive plant is to be built by the North Tonawanda Musical Instrument Company at North Tonawanda, N. Y. This company was recently organized to manufacture automatic and mechanical musical instruments.

An addition to the plant of The Hanson & Van Winkle Company, the well known manufacturers of electroplaters' supplies and equipment, is being made. Their plant is located at 329 Chestnut St.

The E. E. Smalley Plating Company has succeeded the Birmingham Plating Company of Birmingham, Ala. The factory is at 217 North 40th. St. E. E. Smalley is the manager of the company and all kinds of plating, polishing, lacquering and finishing will be carried on.

The Bontempi Rust Proofing Co., 111 Broadway, New York City and works at Bridgeport, Conn., have just issued a booklet describing their process very fully and which will prove of great interest to those who wish to investigate rust-proof finishes. The booklet will be mailed free of charge to those interested.

Davenport & Keeler of New Britain, Conn., the well known industrial and sanitary chemists, make some very attractive quotations for analytical chemical work. For particulars their advertisement in this issue should be consulted. This firm mail reports of analyses within 24 hours of receipt and make a specialty of alloy and metallurgical work. Their laboratory was recently equipped with a new testing machine for testing the tensile-strength of metals.

The Union Pin Company has been organized in Waterbury, Conn., to manufacture pins. A factory has been obtained in Waterbury and which is now occupied by the Harrison Chair Co., and it is expected that manufacturing will be commenced in about two months. The pins will be made on machines developed and constructed by James Kelley of Torrington, Conn. The company comprises James Kelley, Peter Allison and Thomas Murray. Mr. Murray is superintendent of the foundry of the Turner & Seymour Mfg. Co., of Torrington, Conn.

A large deposit of sand, which has been found particularly serviceable for use in sand-blast, has been discovered in Portage County, Ohio. It has been found superior to sea-sand. The deposit is owned by the Portage Silica Co., of Youngstown, Ohio, and is now being mined for sand-blast use. It is stated that it contained practically 99% pure silica. Six different grades of sand are now being supplied for sand-blast use so that all kinds of requirements may be met. The coarser grades are adapted for cleaning iron castings, while the fine grades are used on aluminum castings. The present output is about 500 tons per day.

The Birmingham Stove & Range Co., of Birmingham, Ala., has been incorporated in Birmingham, Ala., with a capital stock of $50,000 to manufacture stoves.

The Russell & Erwin Mfg. Co., of New Britain, Conn., manufacturers of builders' hardware, are to erect a seven story concrete building as an addition to their plant.

The Risdon Tool & Machine Co., of Waterbury, Conn., have increased their capital stock and will move to Naugatuck, Conn., where a piece of land has been purchased.

The Royal Stove Co., was recently incorporated in Oklahoma City, Oklahoma, with a capital stock of $10,000, will manufacture gas stoves. A building has already been obtained and machinery installed.

The Wire Specialty & Machine Works, which recently moved its plant from Chicago, Ill., to South Bend, Ind., is now operating the plant of the Long Distance Telephone Mfg. Co., in addition to its own works. Thorvald Hansen is the superintendent of the factory and the manufacture of wire and metal specialties is carried on.

The Buffalo Copper & Brass Rolling Mill, Buffalo, N. Y., manufacturers of rolled and drawn brass and copper of all kinds, as well as brass and copper tubing, have opened offices at 1216 Flat-Iron Building, New York City and 708-709 Arcade Building Philadelphia, Pa., from which, in addition to their Boston office that has been in existence for some time, the Eastern trade will be handled.

The new factory of the Castle Lamp Company at Elmira, N. Y., which was recently started by them, is well under way, and it is expected that the plant can be moved from its present location in Amesbury, Mass., to Elmira within a short time. The Castle Lamp Company manufacture automobile and carriage lamps and are successors to the Atwood-Castle Co., and the former Atwood Mfg. Co., of Amesbury.

The Divine Bros. Company of Utica, N. Y., the well known manufacturers of buffs and polishing wheels, are receiving from the printers, their new 64 page catalogue of the Compress Polishing Wheels which they manufacture, together with a description of the full line of wheels and goods which they manufacture. The new addition to their plant has just been completed; their plant is now able to take care of orders in a more expeditious manner than heretofore.

The factory recently established by the Harris Typewriter Co., in Fond du Lac, Wis., for the manufacture of typewriters, has been in operation for a short time and the machinery was brought from the former plant in Philadelphia. The plant is located in the factory formerly occupied as the Wells shoe shop. The officers of the company are: President, Julius Keller; vice-president, D. C. Harris; secretary, F. M. Givens; treasurer, S. D. Wyatt; directors, P. B. Haber, F. A. Foster and B. E. Harris.

A new gold and silver refining firm called Oscar R. Boehme & Company has started in Providence, R. I. They are located at 57 Broadway.

The Southern Electrotype Company of Memphis, Tenn., have secured a larger building and will equip a new establishment for the manufacture of electrotypes.

The plant and business of the Mascot Stove Company at Dalton, Ga., is to be sold at auction on Nov. 2nd. The plant has a capacity of 250 stoves per week.

The factory of the Elm Mfg. Co., has been moved from 301 Mulberry St., Newark, N. J., to 48 Oliver St., in the Mockridge Building. Jewelry is manufactured and R. C. Dick is the manager of the company.

The National Cash Register Co., is erecting a new factory at 98 Lombard St., Toronto, Canada which will considerably double their present plant in that city. This factory is a branch of the Dayton, Ohio company.

The O. R. Mitchell Company of Providence, R. I., manufacturers of jewelry, have moved from 95 Pine St. to 62 Page St., the manufacture of bracelets is one of the principal lines.

The International Cash Register Company has been incorporated in Bridgeburg, Ont., Canada for the purpose om manufacturing cash and account registers. A building is being remodeled in that place and when completed manufacturing will be commenced.

The plant of the Williamsville Mfg. Co., of Williamsville, Conn., manufacturers of buffs, has been moved to Danielson, Conn., and new machinery installed. The company will continue to manufacturers the various lines of buffs as they have in the past.

The equipment of the new plant of the Tube Bending and Polishing Machine Company at Bayard and Carroll Sts., Baltimore, Md., has practically all been installed. This company is to manufacture tube-bending and polishing machinery under the patents of L. H. Brinkman.

The name of the Wolff-Trautz Company of Newark, N. J., gold ond silver refiners, sweep smelters and alloy manufacturers, has been changed to the Trautz Company, Inc. John B. Wolff has sold his interest in the company and is no longer connected with it. Charles C. Trautz Sr. is president of the company, and August L. Trautz, secretary and treasurer. The company is located at 9 Delancey St.

R. F. Lang, 31 Broadway, New York City, reports the sales of his various alloys constantly increasing. His "Royal Phosphor-Copper" is now known in all brass foundries and is made in both the 10 and 15 per-cent grades. He also makes "Royal Manganese-Copper" and "Royal 5% Phosphor-Tin." One of his new and novel products is "Ferrool Hocksit" a hard solder for cast-iron. His booklet B. O. describing these alloys will be sent upon application.

A new plating shop, 27 x 33 feet, is to be built by the Morgan Silver Plate Company of Winsted, Conn., manufacturers of coffin-hardware.

The Crane Company of Chicago, Ill., the largest manufacturers of valves in the United States, have bought out the business of J. A. Rose & Co., 27 Bates St., Detroit, Mich., and, it is stated, will erect a plant in that city.

The capital stock of the Scovill Mfg. Co., of Waterbury, Conn., one of the largest manufacturers of rolled brass and small brass goods, is to be increased to $5,000,000 by the issue of 9,386 shares of stock at $100 each.

The George W. Dover Co., of Providence, R. I., manufacturers of metal goods, jewelers' findings, etc., are to move to the top floor of the Hanley Building in that city situated at 56 Pine St. They are located at 710 Eddy St.

The Rushmore Dynamo Works of Plainfield, N. J., manufacturers of automobile lamps and marine searchlights, are having plans drawn up for a new plant in that city. Additional machinery will be installed. This company have operated their own brass foundry for some time.

The New Milford Cold Rolled Steel Co., New Milford, Conn., has been organized to make cold-rolled strip steel. A specialty will be made of the smooth and even grades of steel necessary in the drawing and electroplating trades. A plant has been secured in New Milford and machinery purchased. It is expected that the factory will be ready for business within a month.

The firm of Andrews & Co., of Providence, R. I., silver smelters and refiners, have gone into the hands of a receiver and Royal H. Gladding has been appointed the receiver. He will pay off the indebtedness of the company and, it is reported, will wind up the business. The firm of Andrews & Co., succeeded Cornell & Andrews, silver smelters and refiners, and manufacturers of rolled sterling silver sheet and fine silver anodes. They were in business for many years in Providence.

P. Pryibil, 521 West 41st St., New York City, manufactures an exceptionally complete line of metal spinning lathes and accessories. These lathers are manufactured in two types: The straight bed type and the extension-bed or gap type. The lathes are manufactured for both round and oval spinning. The head and tail stocks are of special design and made so that they run exceptionally true and with the end-thrust well taken care of. The lathes for oval work have been designed with especial care so that it becomes equally as easy to spin an oval shape as one that is round. A special oval chuck is also made of the balanced type which has attractive features for those who have occasion to do oval spinning. P. Pryibil has just issued a very attractive 26 page catalogue of his goods which will be sent when desired. It is profusely illustrated.

A new brass foundry is to be erected by the Cadillac Motor Car Co., of Detroit, Mich. J. J. Wilson is in charge of the foundry department of the company.

The Western Brass Mfg. Co., 2007 Marshall Boulevard, Chicago, Ill., manufacturers of a line of brass goods, are to build a new, two story factory.

The Griswold Mfg. Co., of Erie, Pa., manufacturers of hollow-ware of cast-iron, steel and aluminum, are erecting a two story addition to their works.

The Osier Manufacturing Co., has started in business at 234 Chestnut St., Providence, R. I., to manufacture brass and cheap plated jewelry.

The Rudolph Mfg. Co., of Roselle, Ill., has been organized with a capital stock of $2,500 to manufacture metal novelties. H. J. Mensching, R. H. Rudolph and L. A. Mensching are the incorporators.

The Jarecki Mfg. Co., of Erie, Pa., one of the largest manufacturers of steam-metal goods in the United States, is planning extensive additions to its works. Both brass and iron valves and similar steam goods are manufactured by them.

At a recent meeting of the stockholders of the Goodwin & Kintz Company of Winsted, Conn., manufacturers of soft metal novelties, clocks, etc., and metal spinners, it was voted to increase the capital stock from $50,000 to $100,000.

The business of the Meaker Company, 218 North Elizabeth St., Chicago, Ill., manufacturers of electrogalvanizing equipments, has increased to such an extent that they have found it necessary to increase their plant. It is expected that double the space will be necessary.

Personal.

E. M. Atwood, chemist and metallurgist of the Seymour Mfg. Co., of Seymour, Conn., has resigned his position with the company and will establish a testing and chemical laboratory in New Haven, Conn.

Obituary.

Daniel E. D. MacMurray, president of the Solidarity Watch Case Company, 242 Chestnut St., Brooklyn, N. Y., died at his home on Sept 20th.

Thomas P. Kelly, the head of the well known foundry supply firm of T. P. Kelly & Co., of New York City, died on Sept. 22 at the age of 60 years. He was well known in the trade as an expert on foundry facings.

H. R. Ives, the well known manufacturer of metal bedsteads, and at the head of the H. R. Ives Company of Montreal, Canada, died at his home in that city on Sept. 22, at the age of 78 years. Mr. Ives was born in Plainville, Conn., but located in Montreal in 1859.

Current Metal and Supply Prices.

These Prices are net and are for moderate quantities. Smaller quantities command higher prices. Prices subject to fluctuation.

Acetone, pure, 98-99%	lb.	.22
Acid, Acetic, pure, 30%	lb.	.07
Acid, Arsenious (White Arsenic)	lb.	.20
Acid, Benzoic	lb.	.55
Acid, Boracic (Boric), pure	lb.	.12
Acid, Hydrochloric, see Acid, Muriatic.		
Acid, Hydrofluoric, 30%	lb.	.04
Acid, Hydrofluoric, 50%	lb.	.10
Acid, Muriatic, 20°	lb.	.02
Acid, Muriatic, c. p., 20°	lb.	.07
Acid, Nitric, 38°	lb.	.05⅝
Acid, Nitric, 40°	lb.	.05⅞
Acid, Nitric, 42°	lb.	.06¼
Acid, Nitric, c. p.	lb.	.08
Acid, Sulphuric, 66°	lb.	.01¾
Acid, Sulphuric, c. p.	lb.	.06
Alcohol, Wood	gal.	.50
Alcohol, Denatured	gal.	.55
Alum	lb.	.04
Aluminum, Metallic, in Ingots	lb.	.09¾
Ammonium Sulphate	lb.	.07
Aqua-Fortis, see Acid, Nitric.		
Ammonia Water (Aqua-Ammonia), 20°	lb.	.04¾
Ammonia Water (Aqua-Ammonia), 26°	lb.	.06¼
Ammonia Water, c. p.	lb.	.08
Ammonium Carbonate, lump	lb.	.15
Ammonium Chloride (Sal-Ammoniac)	lb.	.12
Ammonium Hydrosulphuret	lb.	.30
Ammonium Sulphate	lb.	.07
Ammonium Suphocyanate	lb.	.50
Amyl Acetate	gal.	3.00
Antimony	lb.	.08¼
Arsenic, Metallic	lb.	.15
Arsenic, White (Acid Arsenious)	lb.	.20
Argols, White (Cream of Tartar)	lb.	.31
Asphaltum, Commercial	lb.	.05
Asphaltum, Egyptian (Bitumen)	lb.	.30
Benzine	gal.	.15
Benzol, Pure	gal.	.75
Bismuth, Metallic	lb.	2.00
Bitumen, see Asphaltum.		
Blue-Vitriol, see Copper Sulphate.		
Borax, Crystals or Powdered	lb.	.10
Borax Glass	lb.	.35
Cadmium, Metallic	lb.	.75
Carbon Bisulphide	lb.	.10
Calcium Carbonate (Precipitated Chalk)	lb	.10
Chrome-Green	lb.	.50
Copper, Lake, (carload)	lb.	.12½
Copper, Lake (cask)	lb.	.12¾
Copper, Electrolytic, (carload)	lb.	12½
Copper, Electrolytic, (cask)	lb.	.12½
Copper, Casting, (carload)	lb.	.12⅛
Copper Casting (cask)	lb.	.12⅜
Copper Acetate (Verdigris)	lb.	.35
Copper Carbonate, dry	lb.	.25
Copper Sulphate (Blue-Stone)	lb.	.09
Copperas, see Iron Sulphate.		
Corrosive Sublimate, see Mercury Bichloride.		
Cream-Tartar, see Potassium Bitartarate.		
Cryolite	lb.	.12
Cyanide, see Potassium Cyanide.		
Dextrin	lb.	.15
Emery Flour	lb.	.04
Emery, F F & F F F	lb.	.03
Flint, powdered	lb.	.01
Fluor-Spar	lb.	.01¼
Fusel-Oil	gal.	3.00
Gold Chloride	dwt.	.60
Gum Copal	lb.	.30
Gum Guiacum	lb.	.26
Gum Mastic	lb.	.70
Gum Sandarac	lb.	.35
Gum Shellac, brown	lb.	.50
Gum Shellac, white	lb.	.60
Iron Perchloride	lb.	.25
Iron Sulphate (Copperas)	lb.	.05
Lead Acetate (Sugar of Lead)	lb.	.15
Lead, Pig	lb.	.04½
Lead, Red	lb.	.12
Lead, Yellow Oxide (Litharge)	lb.	.12
Liver of Sulphur, see Potassium Sulphide.		
Manganese, Ferro, 80%	lb.	.10
Manganese, Metallic, pure	lb.	.75
Magnesium, Metallic	lb.	1.50
Mercury Bichloride (Corrosive Sublimate)	lb.	.93
Mercury, Metallic (Quicksilver)	lb.	.46½
Mercury Nitrate	lb.	1.50
Mercury Oxide, yellow	lb.	1.80
Nickel and Ammonium Sulphate (Double Salts)	lb.	.08
Nickel Carbonate, dry	lb.	.60
Nickel Chloride	lb.	.50
Nickel Metallic	lb.	.45
Nickel Sulphate (Single Salts)	lb.	.12
Nitre (Saltpetre), see Potassium Nitrate.		
Oil of Vitriol, see Acid, Sulphuric.		
Paraffine	lb.	.15
Phosphorus, yellow	lb.	.40
Phosphorus, red	lb.	1.10
Pitch	lb.	.05
Plaster of Paris, Dental	bbl.	4.00
Platinum Chloride	oz.	25.00
Platinum Metallic	oz.	44.00
Potash-by-Alcohol, in sticks	lb.	.50
Potash, Caustic (Potassium Hydrate)	lb.	.08
Potassium Bichromate	lb.	.14
Potassium Bitartarate (Cream of Tartar)	lb.	.31
Potassium Carbonate (Pearlash)	lb.	.10
Potassium Chlorate	lb.	.15
Potassium Cyanide	lb.	.25
Potassium Iodide	lb.	2.25
Potassium Nitrate (Nitre or Saltpetre)	lb.	.10
Potassium Permanganate	lb.	.17
Potassium, Red Prussiate	lb.	.60
Potassium, Yellow Prussiate	lb.	.24
Potassium Sulphide (Liver of Sulphur)	lb.	.15
Potassium Sulphuret, see Potassium Sulphide.		
Potassium Sulphocyanate	lb.	.70
Pumice, Ground	lb.	.05
Quartz, Powdered	lb.	.01
Rosin, Yellow	lb.	.04
Sal-Ammoniac, see Ammonium Chloride.		
Sal-Soda, see Sodium Carbonate.		
Silver Chloride, dry	oz.	.75
Silver Cyanide	oz.	1.00
Silver, Fine	oz.	.52½
Silver Nitrate, crystals	oz.	.50
Soda-Ash	lb.	.05
Sodium Biborate, see Borax.		
Sodium Bisulphite	lb.	.15
Sodium Carbonate (Sal-Soda), crystals	lb.	.02
Sodium Hydrate (Caustic Soda)	lb.	.05
Sodium Hydrate (Caustic Soda) by Alcohol (in sticks)	lb.	.45
Sodium Hyposulphite ("Hypo")	lb.	.04
Sodium Metallic	lb.	.90
Sodium Nitrate	lb.	.05
Sodium Phosphate	lb.	.09
Sodium Silicate (Water-Glass)	lb.	.04
Soot, Calcined	lb.	.15
Spelter, see Zinc.		
Sugar of Lead, see Lead Acetate.		
Sulphur (Brimstone), in lump	lb.	.05
Tin Chloride	lb.	.43
Tin, Metallic	lb.	.40½
Turpentine, Venice	lb.	.35
Verdigris, see Copper Acetate.		
Water, Distilled	gal.	.15
Water-Glass, see Sodium Silicate.		
Wax, Beeswax, yellow	lb.	.45
Wax, Carnauba	lb.	.70
Whiting (Ground Chalk)	lb.	.02
Zinc Carbonate, dry	lb.	.19
Zinc Chloride	lb.	.12
Zinc, Sulphate	lb.	.06
Zinc, (spelter)	lb.	.06⅛

THE BRASS WORLD AND PLATERS' GUIDE

VOL. VII. BRIDGEPORT, CONN., NOVEMBER, 1911. No. 11.

A MONTHLY JOURNAL DEVOTED TO THE ART OF REFINING, ALLOYING, CASTING, ROLLING, FOUNDING AND ELECTRO-PLATING OF ALL THE NON-FERROUS METALS AND THEIR ALLOYS.

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One of the New Uses for Cadmium.

One of the new uses for metallic cadmium is in the manufacture of tungsten electric light filaments, now so extensively employed in incandescent electric lamps. Tungsten itself cannot be successfully made into the filament by the customary method, employed with other metals, of melting, casting and afterwards drawing into wire. The melting point is too high to allow this to be done. In order to produce the wire in a condition suitable for the filaments, however, an intermediate process is used.

Tungsten, as obtained from its oxide, is always in the form of a heavy, metallic powder. This powder is mixed with an alloy of cadmium, mercury and bismuth in the following proportions:

Cadmium	42%
Mercury	53%
Bismuth	5%

This alloy is smooth and uniform and when heated becomes plastic so that it may readily be impregnated with tungsten powder. The two are ground together in a mortar so that an intimate mixture is produced. The amount of tungsten used is from 30 to 50 per cent of the mixture. To obtain the wire an extrusion method is employed such as that used in making lead pipe. The tungsten and alloy mixture is forced through a die and issues in the form of a wire. The wire is then heated to drive off the alloy after which the temperature is increased to render the tungsten solid. This latter heating is carried out in a vacuum furnace

in order to remove all of the foreign substances in the tungsten.

This use of cadmium is a new one and should result in quite an extensive consumption.

The Field for Electrogalvanizing.

When electrogalvanizing first made its appearance in the scientific world, the exponents of the hot galvanizing process seemed to think there was a possibility that hot galvanizing would be driven from the field, and they raised a great hue and cry about the enormous advantages of hot galvanizing and the imperfect coating that is produced by electrogalvanizing. This hubbub seems to have been ill timed for electrogalvanizing does not appear to have injured the hot-galvanizing trade in the least.

Anything is satisfactory which answers a purpose and this seems to be the case with electrogalvanizing. It appears to have filled a gap in metal coating not heretofore satisfied; and if it has replaced any metal coating process it has substituted nickel or copper plating more than hot galvanizing.

We are not making these statements to champion the cause of electrogalvanizing against hot galvanizing, but feel that the time is ripe for praising it and to indicate its value in many lines of work.

The fact that an electrogalvanizing coating is, in the majority of instances, light, does not in any way affect its value. There are many cases in which a light coating only can be used and it is quite satisfactory. Were it not light, it could not be used. Sheet steel work which could not be hot galvanized is now electrogalvanized to a large extent and has proved to be what is desired.

The object of any zinc coating is not for ornament, but for a rust preventative. It is not imperative that it should preserve the article from rusting indefinitely, but frequently all that is desired is to prevent the goods from rusting while in stock in a hardware store or in a stock room. In other instances a year may be all that is required. In such cases, electrogalvanizing. is satisfactory.

It is surprising how even a light coat of zinc will effectually protect iron or steel against rust. In this respect it is far superior to even a much heavier coating of nickel, copper or brass. Instances are being noticed daily in which electrogalvanized steel is exposed to the air and it seems to protect it against rust in a surprising manner. In fact, it does all that is required of it. It will not, of course, protect the iron or steel for as long a period as hot galvanizing on account of the light zinc coating, but as long as it protects it for the desired period, no more could be asked.

We think we can see a good future for electrogalvanizing, for it certainly has made much progress within the last few years.

Use of Tantalum for Standard Weights.

It has been proposed in France to use metallic tantalum for standard weights. A writer in *Nature* says that owing to the high price of platinum, a suitable substitute for it in the construction of standard weights is desired. Metallic tantalum resists all acids except hydro-fluoric, and has been found to answer all requirements of permanence in the air and hardness.

The suggestion has been made to make a series of 100 gram weights of metallic tantalum for use in chemical research. The cost, it is said, would not be more than one-third of that of the now employed iridium-platinum weights.

The present extensive manufacture of brass sheet in the United States owes its beginning to the demand created for it by the manufacturer of clocks and buttons. The substitution of brass clock wheels for those of wood opened a field for brass sheet that may really be said to be responsible for the creation of the large brass rolling mills in the Naugatuck Valley, Connecticut. The demand for sheet brass for buttons, while extensive at one time, was subject to the caprice of fashion, and while antedating that of clocks, did not survive it to any marked degree. It is probable that the use of sheet brass in clocks now forms the largest single consumption of this commodity.

The nickel in nickel salts, either single or double, costs more than the nickel in nickel anodes. It is cheaper, therefore, to feed a nickel plating solution from the anodes than to supply it by the addition of nickel salts.

The New Plant of the Vanadium Metals Company at Groton, Conn.

The interest that is now being manifested in vanadium and its alloys will, it is believed, result in an equal amount of interest being displayed in plants which work up the alloys. Vanadium has apparently come to stay, so to speak, and its value in steel has been demonstrated to a marked degree. The use of vanadium in the non-ferrous alloys is also creating a large amount of interest, although, of course, such alloys are not as widely used as steel; but it is believed when fully understood by engineers that the vanadium non-ferrous alloys will find a very extensive use in many new lines of work as they already have in shipbuilding and other engineering trades.

Fig. 1. Foundry Building of the Vanadium Metals Company at Groton, Conn.

The beginning of the use of vanadium in metallurgy began several years ago when a large deposit of vanadium ore was discovered in Peru. Heretofore vanadium ores had not been mined to any extent and small lots only had been produced. There had been no use for it and what was mined was used more for mineralogical specimens than for commercial purposes. The opening of this large Peruvian deposit, however, started a new era, for it immediately became possible to produce vanadium alloys at such a low price that experiments were soon started to ascertain whether vanadium could not be employed in steel with good results. The experiments were rewarded with success and from that time on, the consumption of vanadium has constantly increased.

The Peruvian vanadium deposits are owned by the Vanadium Metals Company of Pittsburgh, Pa., who have been responsible for the exploitation of vanadium alloys and who now smelt the vanadium ore and manufacture it into the various mixtures demanded by the trade.

Metallic vanadium is not used in the preparation of the various vanadium alloys for the reason that it is not only too difficult to reduce but has so high a melting point as to be almost infusible. The regular furnace will not melt it. Instead, an alloy is made directly from the

Fig. 2. Interior of the Foundry of the Vanadium Metals Company at Groton, Conn.

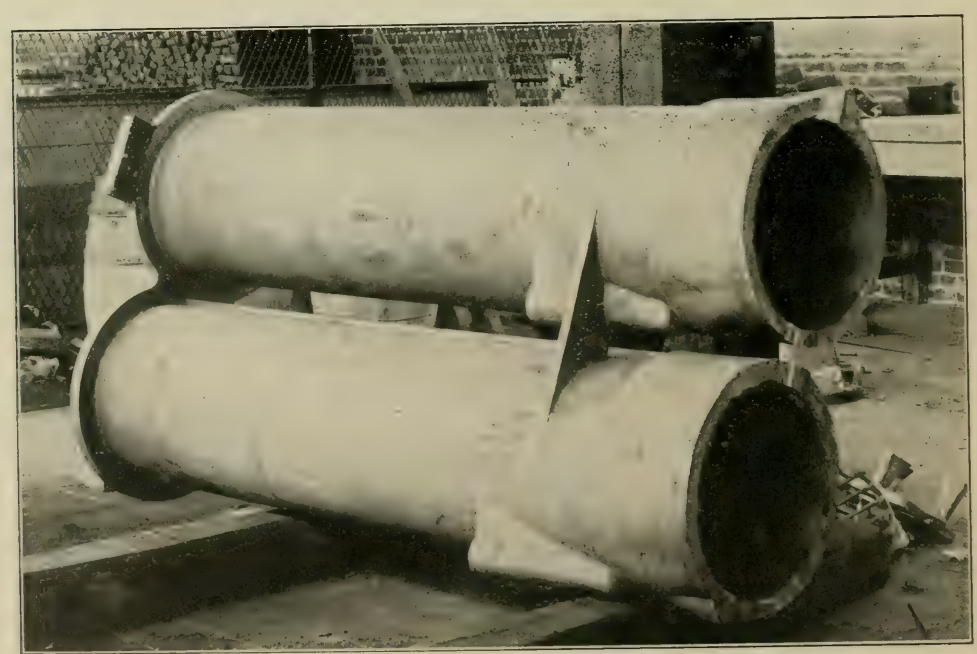


Fig. 3. Torpedo Tubes of Vanadium Bronze. Cast in Green Sand. Weight, 3600 Lbs.

Fig. 4. Cutting the Risers in the Cope of a Large Green Sand Mold at the Works of the Vanadium Metals Company.

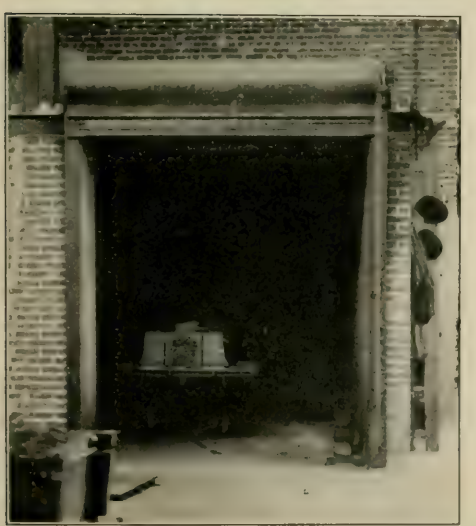


Fig. 5. The Core Oven.

ore and either a ferro-vanadium or a cupro-vanadium is produced. These alloys are then used for introducing the vanadium into the various different products sold as commercial vanadium alloys.

When vanadium was first found of value in the manufacture of steel, the promoters looked around for a field for it in the non-ferrous metal line and selected Victor Lassen, then manager of the Victor Metals Company of East Braintree, Mass., as one who had the capabilities and facilities for carrying on the work. The vanadium people asked Mr. Lassen if he would be willing to carry on some experiments with vanadium with a view to ascertaining whether the metal could be advantageously employed in the non-ferrous alloys. His reply was that he had been using vanadium in his alloys for several years and that it was nothing new to him. The result was that the plant of the Victor Metals Company was purchased by the Vanadium Metals Company of Pittsburgh and Mr. Lassen made manager. The plant was then conducted as before, but owing to the fact that the vanadium ores

were controlled by the company, there was no necessity for keeping the fact secret that metallic vanadium was an ingredient of the alloys, so the name of the company was changed to the Vanadium Metals Company and the fact made known that vanadium was actually used. Previous to the sale to the vanadium people, Mr. Lassen had maintained the use of vanadium in his alloys as a trade secret.

Since the purchase of the plant of the old Victor Metals Company at East Braintree, Mass., by the Vanadium Metals Co., of Pittsburgh, Pa., the business had increased to such an extent that additional room was required, particularly for the manufacture of large castings. The demand for large marine work was such that this became quite imperative and it was decided to build a new plant in Groton, Conn., across the harbor from New London, Conn. The plant is located on the shore within a short distance from that of the old Eastern Shipbuilding Co., and now occupied by the new shipbuilding plant. In Fig. 1 this plant is shown. It consists of a one-story brick and steel building and was designed exclusively for the manufacture of large castings. The plant of the Vanadium Metals Company at East Braintree, Mass., is still in operation and will be continued for the manufacture of small castings. In other words, the East Braintree plant will carry on the manufacture of small and special work, while the Groton plant will conduct the manufacture of large castings.

As will be noticed from Fig. 1, the building consists of a main structure with wings on either side and ample light in the roof for rendering the molding as easy as possible. In Fig. 2 is shown the interior of the foundry looking towards the furnace end. A travelling crane of a size that will take all classes of work runs from one end of the building to another and also directly over the furnaces. It is possible, therefore, to handle the metal rapidly and carry it to the mold at whatever part of the shop it may be. In the wings of the building, bench molding is carried on, although the castings made are of fairly good size. It has been found expedient to make

Fig. 6. Battery of Large Crucibles Furnaces.

some of the small castings here, rather than in the East Braintree plant for the reason that such castings may be part of the order for large work and both kinds of castings may then be poured from the one heat. As practically all the castings made at the plant are specification work, it is quite essential that both the large and the small ones shall be cast of the same metal. It is for this reason that some small work is made at the Groton plant.

The class of work done at the Groton plant may be appreciated by reference to Fig. 3 a large vanadium-bronze casting for a torpedo

Fig. 7. Vanadium-Aluminum Castings.

tube. This casting is not only a difficult one to make in any kind of strong metal on account of the necessity of placing risers on the heavy portions to compensate for the shrinkage, but when it is realized that this particular casting weighs 3600 lbs. the magnitude of the work carried on may readily be understood. In Fig. 4 is shown a large mold in process of construction and this, also, is to be used for casting marine work.

Large work of this character necessitates ample core-space and in Fig. 5 may be seen the oven used at the plant. This oven is heated by coal and it has been found that coal reclaimed from furnace ashes makes an excellent fire. It gives a slow, even heat so much desired in the drying of cores. The oven is provided with a roll-lift door making it easy to open.

The furnaces at the plant are shown in Fig. 6 and are of the regular pit type. The battery shown in Fig. 6 is intended for large crucibles and No. 250's are generally employed. At the other side, not shown in the photograph, is a battery of smaller furnaces in which medium sizes crucibles are used. Hard coal is used for the fuel and natural draft employed. An iron stack shown in Fig. 1 serves the furnaces.

Among the products of the plant are vanadium aluminum castings in which aluminum is used. Some of these castings are shown in Fig. 7 and it is claimed that an average tensile strength of 25,000 lbs. can be obtained.

The vanadium used at the plant of the Vanadium Metals Company is either in the form of ferro-vanadium or cupro-vanadium. As iron is an ingredient of some of the bronzes, it has been found expedient to employ the ferro-vanadium in such cases as both the iron and the vanadium can be introduced at once. For the properties of the vanadium bronzes, the reader is referred to THE BRASS WORLD, July, 1911, page 244. This article is by George L. Norris, the metallurgical expert of the Vanadium Metals Co.

Novel Method for the Removal of Rust from Iron and Steel.

The removal of rust from iron or steel is usually an unsatisfactory process when an acid pickle is employed. The acid attacks the metal as well as the rust. A novel method of removing rust without attacking the metal has been described by H. Jacob and R. Kaesbohrer in *Chem. Zeit.* 35, 1911.

The iron or steel, from which the rust is to be removed, is made the cathode in a dilute solution of sodium sulphate containing from 0.25 to 5 per cent of sodium sulphate in water. Carbon plates are used for the anode. The hydrogen gas evolved at the cathode reduces the rust so that it may be brushed off or removes it entirely. A weak current is employed and the article allowed to remain in the solution over night.

The authors state that the removal of the rust is so complete and the iron or steel is so free from attack that the method may be employed for its accurate determination.

Gold Plated Automobile Lamp Reflectors.

The manufacture of reflectors for automobile lamps is now receiving much attention. For acetylene lamps, glass, silvered on the back is used and is quite satisfactory as it does not tarnish or corrode. It rarely breaks as it is made of special quality for this very purpose. Owing to the flat flame, a parabolic reflector cannot be used in an acetylene lamp, but the surface is a true arc of a circle. A metallic mirror for an acetylene lamp is unnecessary as the glass seems to fill the requirements quite well.

Many automobiles are now being equipped with electric headlights and in these a parabolic reflector can be used on account of the light being more of a point, as required to obtain the best results with a parabolic mirror. For this purpose a metallic mirror is necessary on account of the difficulty of making a glass reflector of such a shape. A metallic reflector in an electric headlight is not subjected to any tarnishing influence from gases, such as would take place with an acetylene lamp, nor would dust and dirt affect it for the reason that it could be practically hermetically sealed. On this account a parabolic, metallic mirror is the logical reflector for an electric headlight.

While the function of a headlight is to throw a powerful light ahead, it is open to the objection that it blinds, to a certain extent, an automobilist who may be coming in the opposite direction and desires to pass. This glare is now a very serious matter and some of the large cities have passed laws preventing the use of powerful headlights within their domains.

Attention is called to an article in this issue on "Metallic Mirrors" in which it is stated that a gold plated reflector has a distinct advantage over a silver plated one in that, while the light is sufficiently penetrating and illuminates well, it is less glaring. This fact has been fully demonstrated in the lights of lighthouses on the coast. When electric lights first made their appearance, they were tried in place of the customary oil lamps, but mariners soon complained of their glare and absence of penetrating power, particularly in a fog. Return to the oil flame with its yellow light soon demonstrated that this light has greater penetrating power than a blue light.

We believe that makers of automobile lamps will find it to their advantage to read this article previously mentioned as it may be found that a gold plated reflector will solve the problem of glaring automobile headlights, at least partially.

An Improved Method of Refining Silver Bullion (from "Cobalt" Ores).

The refining of silver bullion obtained from the so-called "Cobalt" ores of Canada has always been an unsatisfactory problem for the reason that it contains so much arsenic, antimony and cobalt. These foreign elements render the refining difficult and the last traces are removed only with trouble. It is well known that silver is very sensitive to foreign metals and unless they are practically all removed, the silver is unsuited for use in the arts.

A process for refining silver bullion has recently been patented by Balmer Neilly of Bradford, Ont. Canada (U. S. Patent, 1,004,676 Oct. 3, 1911) which is capable, the inventor states, of removing the arsenic, antimony, copper cobalt and nickel. The process used is described in the following manner:

The bullion to be refined is melted in a crucible in an oil furnace to a temperature of about 1140° C. and iron, in the form of nails is introduced and allowed to remain until attacked by the arsenic and antimony. The crucible is then removed and cooled suddenly. A speiss is formed which, under these conditions, separates cleanly from the silver bullion. The bullion is again melted and enough borax or other flux added to form a thin coating on the top when melted. A blast of air is now allowed to play on the surface of the molten metal which causes a depression of about one-quarter of an inch. The arsenic and antimony that are left in the silver are now oxidized and the point at which this occurs is easily determined by dipping out samples and hammering when cool. If the sample is inclined to be brittle at all, it indicates that some impurities still remain and further refining must be carried on.

Even a fraction of a per cent of impurities remaining in the silver will cause brittleness so that it will crack on hammering. In refining by means of the air blast, the silver, as it begins to become pure, will change from a white to a clear, sea-green color while in the melted condition.

Metallic Mirrors

By J. A. Seager.

It has in the past been taken for granted by most people that the whiter and more powerful the light emitted from any source, such as a searchlight, the more powerful would be the illumination obtained. This however, is by no means the case and it is well known that the rays of refrangibility, which are the red and yellow rays, are far less capable of absorption by the atmosphere than the violet rays. A well known example of this is capable of demonstration in any of our large cities, and is the fact of the comparative penetrating power of gas and the electric arc in a fog. The high powered arc lamp is visible at a much shorter distance than the gas arc while at sea the electric flashes from a modern lighthouse have been found to be far less penetrating than the rays of the older oil lamp. Again, the red colour exhibited by the sun at its setting is also due to the fact that violet rays are largely absorbed by the greater thickness of atmosphere to be penetrated by the sun's rays.

This being the case, it is interesting to review a process invented by Sherard-Cowper-Coles of London for the manufacture of parabolic reflectors made of metal, and capable of being coated with either gold or silver. Parabolic reflectors are now used for such a variety of purposes, ranging from their employment in lighthouses to the locomotive headlight and the military and naval searchlight, and the subject is of the very highest importance. Both in the war between America and Spain, and in the Russo-Japanese operations the searchlight was a very potent adjunct both of defence and attack. One of the greatest weaknesses of the older searchlights is that they are made of glass and are very liable to fracture, either with the concussive shock due to the firing of heavy guns in their vicinity or to rifle fire from an

Fig. 1. Plating Plant in which the Mirrors are Silver or Gold Plated.

enemy. In this case the searchlight would be put out of action, and the ground in front which should be swept by the rays would present a favourable zone for the undetected advance of an enemy. For this reason the metallic mirrors manufactured by the Cowper-Coles process are very valuable, as they are not fractured by concussive force, and even when fractured by bullets the area of distortion is very small. This is very well illustrated by Fig. 2 which shows a metallic mirror after being exposed to rifle-shot direct firing either from the back or front, which only results in a very small fracture, leaving the rays of the surface available for reflective purposes, while even a glance shot has only a very small effect in tearing up the surface.

The great difficulty which has hitherto been experienced in making metallic mirrors for searchlight purposes has been the fact that when exposed to the intense heat of an arc lamp of very high candle power they tend to warp and so distort the beam, and moreover, when exposed to damp and brine in conjunction with high heat they are very apt to tarnish. Where, as in the case of ordinary motor car reflectors, stamping was resorted to to obtain the shape, the texture of the material is very apparent and diminishes the reflecting power of the surface, while in searchlight practice, where a true beam is essential, any attempt at spinning the metal produces slight distortions which destroy the value to a great extent of the finished article as a true parabolic surface of reflection. The process adopted by Mr. Cowper-Coles is one which obviates any subsequent processes for the purpose of polishing or obtaining truth, and it is very easy to produce any number of replicas of the same pattern at low cost after the original mould has once been made. In order to produce this mould, a convex casting of iron is made having a curvature approximately that of the finished mirror. The refractory material is then placed in this mould which forms the basis for a coating of glass about 1 inch thick, which is subjected to a temperature near its fusing point in order to enable it to set firmly to the refractory material. This glass is then ground and polished on its convex side, very great care being taken to obtain truth in the grinding and finish in the polishing, the final polishing being obtained by means of pads covered with rouge powder. Extreme care being taken in this portion of the process the preparation of such a matrix sometimes lasts several weeks.

The material is then cleaned and chemically coated with a layer of metallic silver, which is then polished and an electro deposition of copper on to the silver is performed by placing the silver in a copper sulphate electrolyte and revolving the frame containing the metal in a horizontal position at about 5 to 10 revolutions per minute. A current of about 20 amperes per square foot is employed. This part of the process needs to be conducted with considerable care and judgment, as, if too slow a speed is employed, irregularities of deposits are obtained, such as are shown in Figs. 3 and 4. The reflector, thus formed is removed from the glass mould by immersing the whole arrangement in moderately warm water and raising the temperature gradually to over boiling point. Due to the unequal coefficient of expansion of glass and copper the latter separates itself from the mould and we obtain a highly polished parabolic shell with a silvered surface. In order to protect this silver from the subsequent action of atmosphere it is necessary to coat it with a thin film of metallic palladium or platinum, and the mirror is then ready for mounting in a clamping frame so arranged as to hold the mirror without any distortion and provide a stiffening against mechanical strains. Fig. 1 shows the room in which the processes are followed. (A) is the main deposit vat in which the copper is deposited on to the silver; (B) is the silvering vat in which ammonia is added to the soluton of silver nitrate until a clear solution is obtained, which is re-precipitated with caustic soda and again dissolved with ammonia. Glucose in solution is then added and the mould is dipped face downward into the vat after having been cleaned with ammonia. Silver is then deposited by this means on to the mould in three to five minutes, and this deposit is continued until the thickness is about three-millionths of an inch which is a sufficient basis for the copper deposit. (C) is one of the glass moulds upon which the copper has been deposited and which lies ready for the latter to be expanded off. (D) is a smaller former for the purpose of manufacturing headlights for locomotives, while (E) is the depositing vat for these headlight mirrors and (F) is a glass former which has just been taken out of a silvering vat and is ready for the copper deposit.

It is interesting to note the optical test to which these mirrors are subjected. The mirror is placed in front of a screen having squares marked upon it by the intersection of straight parallel lines. At the centre of this screen and at the back is placed a pin hole camera and the image of the screen reflected

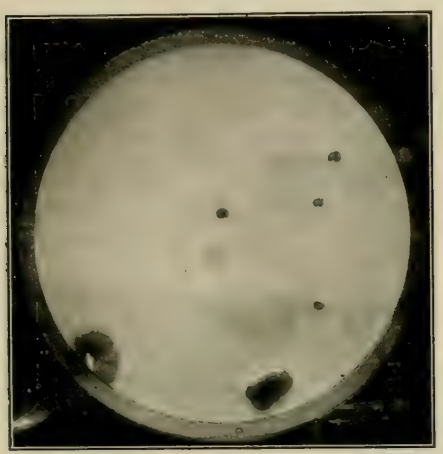


Fig. 2. Mirror Penetrated by a Shot. Showing that it is Not Injured fo Any Extent.

through the mirror is photographed. If the mirror is perfect the print obtained would show a network of lines at true right angles, and it will be seen that in the illustration obtained in this way the only distortion at all

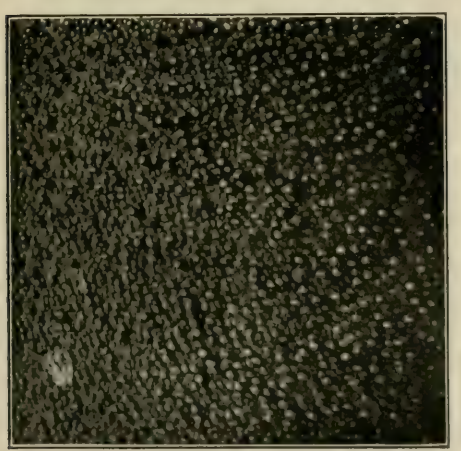


Fig. 3. Rough Surface Produced by Imperfect Plating.

apparent is very near the edge of the mirror. One of the great advantages of metallic mirrors is that they are not liable to crack by the heat of an arc, and therefore can be made of a short focal length the surface being brought up much closer to the arc and there is, therefore, not so much obscuration of light from the crater of the arc. Tests have been taken on these metal mirrors by spraying salt water on to the reflectors when they have been so hot as to burn the fingers, the white deposit left being easily cleaned off with a soft cloth, no other damage resulting.

One of the latest advantages in the construction of these mirrors is the production of gold surfaces instead of silver ones. A long series of experiments made with gold mirrors against silver mirrors showed that when using the former the beam of light is practically devoid of the blue and yellow rays

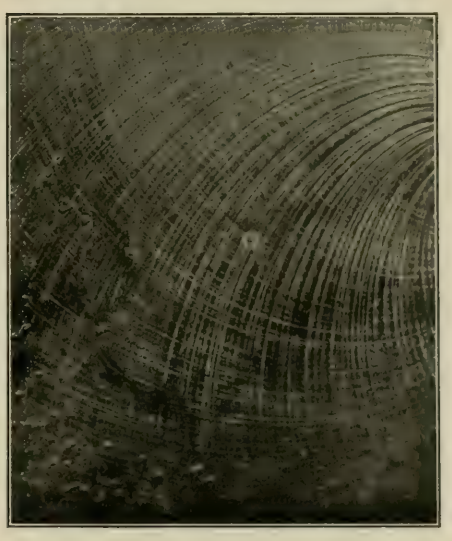


Fig. 4. Streaked Surface Produced by Imperfect Plating.

of the spectrum, being composed of red, yellow and green rays only. At the same time the range or penetrative power of the mirror was not reduced and by the elimination of the violet rays the dazzling effect is done away with. In order to show that the chief advantage claimed for the gold mirror that the light reflected from it is more penetrative than the light reflected from a silver mirror in thick and foggy weather showing up distant objects more clearly, Fig. 5 shows two photographs which were taken of a photographic enlargement of a torpedo boat set up in a

dark room and illuminated by gold and silver beams. The plates were developed in the same bath for exactly the same time and the prints were made in the same frame, so that the conditions were as far as possible identical, and every precaution was taken to ensure that the results should be comparative in every way. The two prints speak for themselves as regards the volume of light which was thrown on to the object. Another great advantage claimed for these gold mirrors is that when they are employed for motor car headlights they are less dazzling than headlights fitted with silver mirrors. In exhaustive tests carried out by the Royal Automobile

Fig. 5. Photographs taken with Light Reflected from Gold and Silver Mirrors.

Club of Great Britain the only three lamps fitted with the Cowper-Coles gold mirrors secured the first three places for maximum distance at which dazzle ceased. These mirrors, which are manufactured by electro deposition in a similar manner to that described above are, when made for motor car headlights, supplied in a special headlight constructed with an inner and outer case. As the headlight, therefore only consists of three parts it is very accessible for cleaning purposes. The gold mirror is also being employed for searchlight purposes because of the fact that its beam penetrates fog in a much more efficient manner than the older type of ray.

It will be apparent from the above notes that a distinctive advance has been made in searchlight design inasmuch as the objects on which the light is thrown stand out in greater relief, the mirrors are lighter than glass mirrors and are more durable, they reflect a larger quantity of light than glass mirrors, and therefore, the intensity of the light is so great that it is impossible to aim accurately upon the projector, and where a combination mirror having gold and silver bands is employed, the dazzling effect required for some military purposes is retained.

Pyrophoric Metal Alloys.

The ordinary pyrophoric alloy employed for sparking devices consists of the following:

Cerium	70%
Iron	30%

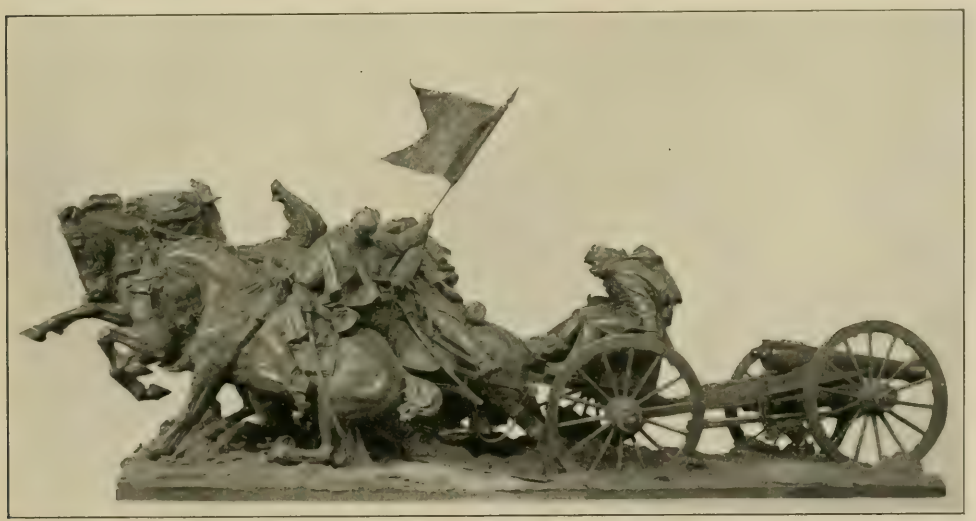
This alloy, when filed or scraped by a hard substance, emits sparks which are capable of igniting various inflammable liquids such as gasoline or alcohol. These alloys are now extensively employed in self-lighting gas lighters, match-boxes, etc.

In these alloys the cerium is an expensive ingredient and attempts have been made to produce cheaper ones. A patent has recently been issued to Georg Friederich Hofman of Munich, Germany for a cheaper alloy. This inventor says that alloys of manganese and antimony are somewhat pyrophoric, but require cutting with a special tool in order to produce sparks. The hardness, however, of such alloys is so great that any special tool or device of this character used for cutting them rapidly wears out. The addition of soft metals like lead, in order to overcome the extreme hardness changes their nature so that they will not emit sparks.

The inventor found that if 5% of cerium be added to an alloy of manganese and antimony, it becomes so softened to such an extent that it will not injure the tool appreciably and still will have the pyrophoric property. The small quantity of cerium used renders the alloy much cheaper than the ordinary iron and cerium alloy containing 70% of cerium and now employed for pyrophoric purposes.

The Largest Bronze Group Cast in America.

The Roman Bronze Works of Brooklyn, N. Y., has just completed the largest bronze group ever cast in America. This group is herewith shown and is known as the "Artillery Group". It is to be erected on the General Grant monument in Washington, D. C., of which Edward Pearce Casey is the architect. Henry Merwin Shrady was the sculptor of the group which has been cast in statuary bronze of the finest grade. It is well known that the casting of a statue of this character requires a bronze mixture about which there can be no question as the operation is too serious to admit of any chance whatever being taken.



Largest Bronze Group Cast in America. Made by the Roman Bronze Works of Brooklyn, N. Y. by the "Cire-Perdue" Process, (Lost Wax Process), for the General Grant Monument in Washington, D. C.

The weight of the statue or group is 28,600 lbs. or over 14 tons. The length is 28 feet, the height 11 feet and the width 10 feet. The group represents the artillery of the United States Troops in action during the Civil War.

Fluor-spar alone does not make a good flux for use in melting metals in crucibles as it rapidly attacks the clay in the crucible mixture and dissolves it. By mixing it with lime so that its fusibility is reduced, it can be prevented from acting upon the crucible.

U. S. Government Formula for Browning Steel Gun-Barrels.

The following is the standard formula of the United States Government for use in browning gun-barrels and similar steel articles.

Alcohol	1½ oz.
Tincture of Iron	1½ oz.
Corrosive Sublimate	1½ oz.
Sweet Spirits of Nitre	1½ oz.
Blue Vitriol	1 oz.
Nitric Acid	¾ oz.
Warm Water	1 qt.

Dissolve the ingredients in the water and keep in a glass bottle.

The gun-barrel to be treated is cleaned with potash or soda to remove the grease and all stains are then scoured off with fine emery paper so that an even, bright surface is produced. The bore and vent of the barrel are closed by plugs of wood.

The solution is then applied to the surface of the steel with a sponge and allowed to dry in the air for 24 hours, after which the loose rust should be rubbed off with a steel scratch brush. Now apply another coating and allow to dry in the same manner and then rub off with the scratch brush again. Finally wash off with boiling water, dry rapidly and wipe with boiled linseed oil or give a coat of lacquer.

Correspondence.

Fire-Cracking of Steel Shells.

Editor:

I was glad to note the article in the June issue of THE BRASS WORLD entitled: "The Fire Cracking of Drawn Steel Shells During Galvanizing", but am not prepared to accept your diagnosis as entirely explaining the cause of the breakage. If we assume that a piece of stock, owing either to certain incorrect chemical analysis or insufficient analysis, comes from the drawing dies in a condition where it is at the critical point of rupture, and that it is helped over this critical point to actual breakage by the occlusion of hydrogen gas during pickling and galvanizing, then your diagnosis is plausible.

However, several experiences of ours apparently discount this conclusion; one being that shells made from tin-plate and received from the presses in good condition, break after being soaked in grease and molten tin in the retinning process. In this case, we have the same breakage results but with no pickling to cause occlusion or absorption of hydrogen gas. The percentage of breakage is greater on IC than on IXX stock where an article is made on the same set of dies, but of different weights of stock.

From this, one would naturally deduce an opinion that in retinning, the stock, showing the smaller amount of breakage, would stand up best in retinning. This again is just the reverse of our experience as certain articles made of IXX stock break to a greater percentage after being retinned than the same articles when made of IC tin-plate.

This leads me to mention another experience. We made tin-plate shells approximately 2 in. in diameter by 2⅛ in. high. These were made in one draw and three reductions. Four different makes of tin-plate were used in weights of 85, 90 and 95 pound, and in all cases the shells were so brittle that they would not stand subsequent operation. The fifth make of stock was 85 pound in weight and 65,000 shells were made from it which were so pliable as to allow the walls to be bowed to half the original diameter without any breakage. This would appear to put it up to either the analysis or the annealing before the steel sheets were tinned.

In this connection, an interesting analysis was made of annealed steel stock which, though it appeared and really was soft as putty, would not stand drawing without a large breakage. The grain at the fracture had a coarse appearance and the character of "hot-short" brass and an analysis showed the following proportions:

Carbon	trace
Sulphur	0.045%
Phosphorus	0.076%
Manganese	0.460%

A steel, used in place of the above and which was very satisfactory, showed an analysis:

Carbon	0.120%
Sulphur	0.035%
Phosphorus	0.044%
Manganese	0.440%

The first of the preceding analyses was passed upon by disinterested steel makers who reported that they were at loss to understand how a mill could expect this class of stock to be used successfully for deep drawing, and that it was evident that the maker, in his endeavors to obtain a low carbon content, "over-blew" his steel, thus eliminating practically all the carbon.

Probably "over-blown" steel was the reason in another case where the stock, after being galvanized, could be torn in pieces like so much blotting-paper. There must evidently be a critical point in the character of the annealing as well as the correct analysis of the steel, which marks the distinction between good and poor drawing stock.

Occlusion of hydrogen gas may have an important bearing on some processes, but since annealing will absolutely prevent a galvanized shell cracking, even though we admit occlusion of hydrogen gas, there must be some agency, other than this one, which contributes to a greater degree to the fire-cracking of steel shells during galvanizing.

T. R. Hugo.

Republic Metalware Co.,
Buffalo, N. Y.

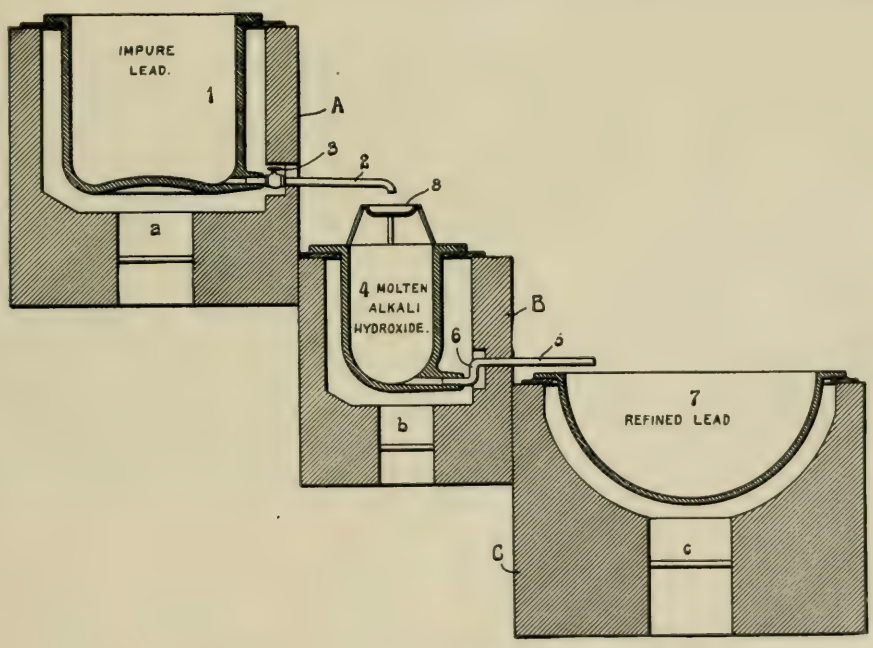
Palladium can be electrodeposited in a white coating on metals and is not tarnished by atmospheric influences. While not as white as silver, the deposit of palladium is whiter than platinum and closely resembles a very white nickel deposit.

A New Process for Refining Antimonial-Lead and Other Lead Alloys.

Antimonial-lead is now very extensively used in the manufacture of type metals of all kinds, babbitt-metals and metal novelties; in fact, its employment is so extensive that very little pure antimony is used in making such mixtures unless a very accurate and pure mixture is desired. Antimonial-lead is a by-product in the smelting and refining of silver and, therefore, the contained antimony is much cheaper than when the pure metal is employed for the manufacture of the lead and antimony mixtures. Hence the extensive use of antimonial lead.

A new process for the removal of the arsenic has recently been patented by Leland E. Wemple of the Hoyt Metal Company of St. Louis, Mo. This procss makes use of the fact that molten caustic soda, when in contact with the molten antimonial-lead, will remove the arsenic without appreciably removing the antimony. While this is the principle of the process, the carrying out of the operation demands special apparatus herewith illustrated.

The impure antimonial lead is melted in an iron kettle 1 and is allowed to flow, in drops or a small stream, into a second kettle 4 containing molten caustic soda. As the antimonial-lead slowly passes through the molten caustic soda, a large surface is exposed and



Apparatus and Process of Refining Antimonial-Lead.

As obtained in the refining of silver, antimonial-lead is quite impure and arsenic is the chief impurity. It has been somewhat difficult to remove the arsenic from the commercial antimonial-lead and in the past it was not unusual to find five or six per cent of this metal in it so that its value was greatly diminished. The type-metals, babbitt-metals and other alloys that were made from it, were of an inferior grade. The removal, to as great a degree as possible, of the arsenic is very necessary.

the arsenic removed from it. After a time, the caustic soda becomes so contaminated with arsenic that it must be replaced by a fresh supply. Caustic potash acts equally as well as the caustic soda, but is more expensive and the results are no better.

In the bottom of the kettle 4 is a bent pipe or "trap" through which the refined lead flows into the kettle 7, known as the "refined lead" receptacle and from which it is poured or ladled into the molds. This pipe prevents the caustic soda from flowing into the refined

lead kettle along with the lead. On the top of the caustic soda kettle 4 is a basin 8 through which the impure lead flows, and its object is to break up the stream of lead and divide it into as small particles as possible and thus expose the maximum amount of surface to the action of the caustic soda.

While the trap effectually prevents the entrance into the refined lead kettle of practically all of the caustic soda, a small quantity is apt to enter and to remove this a small quantity of nitre-cake (hydrogen sodium sulphate) in the anhydrous state is added to the refined lead. This neutralizes the caustic soda and renders it inert so that it will not continue to attack the lead and antimony, or cover the lead when ladled out into the molds. The sodium peroxide or potassium chlorate are mentioned. These, however, are added singly and not together and the action of the nitre, sodium peroxide or potassium chlorate is the same and one is used as a substitute for the other. The sulphur, however, acts differently from the others. To use, the desired substance, be it sulphur or nitre, is mixed with the caustic soda.

Some Analyses of the Different Grades of Commercial Pig Tin.

The London Metal Exchange has issued new rules for dealing in pig tin and which are intended to render it possible to supply a number of different brands as standard instead of a few as heretofore. The object is to minimize a "corner" as much as possible, should it be possible for an operator to attempt it. Accompanying these rules are the following analyses of a number of different brands of tin. For this information we are indebted to the *Ironmonger* which has carefully described the situation in detail:

	Tin	Antimony	Arsenic	Lead	Bismuth	Copper	Iron	Silver	Sulphur	
Banca Tin	99.950	.007	nil	trace	nil	.018	.045	nil	trace	
Billiton ,, ...	99.960	.006	nil	nil	nil	.023	nil	nil	nil	
Penang ,, ...	99.939	trace	.013	trace	nil	.016	.028	nil	.004	
Singapore Tin	99.870	.008	.045	.034	.003	.052	.003	.006	.005	
Mt. Bischoff	99.795	.015	.063	.037	.005	.035	.042	trace	.008	
Pyrmont Tin	99.938	.017	.019	trace	nil	.022	trace	nil	.004	
Irvine Bank	99.580	.062	.034	.221	.025	.128	.002	.018	.004	
Williams, Harvey & Co. No. 1..	99.860	.015	.040	.004	.005	.047	.003	nil	.006	
Williams, Harvey & Co. No. 2...	99.560	.166	.037	.162	.007	.050	.005	trace	.013	
Williams, Harvey & Co. No. 2a	99.350	.245	.065	.223	.015	.042	.016	trace	.013	
Williams, Harvey & Co. No. 3...	99.200	.300	.037	.396	.007	.100	.013	.014	.006	
Williams, Harvey & Co. No. 4...	99.941	.011	.022	trace	.001	.020	trace	trace	.005	
Penpoll No. 1	99.720	.118	.054	.041	.007	.052	.001	.009	.007	
Penpoll No. 2	98.710	.569	.042	.546	.055	.103	.007	.015	.004	
Penpoll No. 3	99.300	.325	.056	.212	.050	.088	.002	.021	.009	
Redruth	99.160	.176	.053	.177	.017	.445	.014	.006	.008	Cobalt .012
Th. Goldschmidt No. 1	99.860	.004	nil	.102	nil	.043	trace	nil	trace	
Th. Goldschmidt No. 2	99.460	.015	nil	.425	nil	.069	trace	nil	trace	Traces
Th. Goldschmidt No. 3	99.150	.122	.046	.143	.112	.352	.007	.003	trace	& Loss
Chinese No. 1	99.343	.031	.040	.434	.007	.052	.010	trace	.011	.072
Wing Hong & Co. No. 2... ...	98.162	.039	.035	1.035	.012	.134	.014	trace	.011	.058
Wing Hong & Co. No. 3... ...	95.280	.381	.050	3.995	.020	.106	.026	.018	.008	.116

Analyses of Commercial Brands of Pig Tin.

These analyses will be of interest and possibly of value to manufacturers who use tin, as such a compilation of results and of such a number of brands has not heretofore been published.

The first sheet brass to be rolled in the United States was cast in Waterbury, Conn., and carried to an iron mill in Litchfield, Conn., where it was rolled into sheet for the manufacture of buttons. The copper was obtained from old copper stills.

Electrolytic Refining at the U. S. Mint, San Francisco, Cal.*

By Edward B. Dunham. E. M.

The Treasury Department maintains five refineries for the treatment of the gold and silver bullion deposited at the various mints and assay offices. The original installation in each case was the nitric acid process of refining. This was succeeded some 30 years ago by the sulphuric acid process, which in turn is now being displaced by the electrolytic process.

The electrolytic process was installed in the Philadelphia Mint in 1902, in the Denver Mint in 1906 and in the San Francisco Mint in 1908. It will be used in the New York Assay Office upon the completion of the new building; and the refinery of the New Orleans Mint, where the amount of work is comparatively small, will then be the only Government refinery using the sulphuric acid process.

The Mints and Assay Offices accept bullion carrying more than 200 thousandths precious metals. The refining charges run from 1 cent an ounce on good silver bullion, up to 8 cents an ounce on bullion carrying 800 thousandths base. The charges on ordinary gold bullion average 4 cents per ounce. On account of these very high charges on base bullion, most of it is sent to private refineries, where the facilities for handling this grade of material are better, and the refining charges are consequently less than at the mints.

In the silver process at the San Francisco Mint, the initial treatment of the bullion is in vertical cells. These are a modification, devised in the Philadelphia Mint, of the Moebius cells. The scraps from the vertical cells are re-treated in the horizontal cells, which are a modification of the Thum cells. Both types of cells have their advantages and disadvantages.

Fig. 1. The Melting Room of the San Francisco Mint.

For refineries where the silver-bullion is the product of cupel-furnaces, and carries less than from 10 to 20 ,thousandths base metal there is no question as to the superiority of the horizontal process.

In mint-work the case is different. The bullion carries from 100 to 150 thousandths base and from 300 to 400 thousandths gold; the base requires an excess of acid to put it in solution, and the large amount of gold necessitates current for parting, in addition to that needed to dissolve the silver. The presence of the excess acid and of the heavy currents tends to destroy the filter cloths quickly.

The gold process used at all the mints is the invention of Dr. Emil Wohlwill, of Ham-

*Abstract of a paper presented at the Meeting of the American Institute of Mining Engineers, held in San Francisco, Cal., Oct. 10-20th. 1911.

burg, Germany, and was the outcome of experiments to separate platinum from gold. It was introduced by him into several refineries in Europe, and was first installed in this country in the Philadelphia Mint; but, so far as I know, no private refinery in this country is using it.

The electrolytic process of gold-refining possesses three advantages that are important in mint-work. First, it produces purer gold than the old processes. The elimination of the last trace of silver from the gold removes the brittleness from the ingots used for coinage, so that they roll and press much better than alloys of the same fineness in gold, but made of slightly impure gold. Second, the process permits the saving of all the platinum metals without serious inconvenience. Third, the operations do not give off, as do former processes, great quantities of acid fumes, such as used to cause frequent complaints from the people living in the vicinity of the mints, which were all located in cities.

The electrolytic processes of gold-refining has three disadvantages as compared with the sulphuric acid process. First, it is more expensive. Second, more care and intelligence are required to conduct it. Third, the losses are liable to be greater on account of having gold in solution in the electrolyte.

In mint-work, the advantages more than offset the disadvantages; but in commercial work, the advantages mentioned are of less importance, and the large amount of precious metal invested in the process, with the resulting loss of interest, would be almost prohibitory of its use. This failure is not so important to the Government, as the metal so tied up may be considered as a part of the gold reserve, and is accounted for at the time of annual settlements.

The refinery at the San Francisco Mint takes the bullion purchased by the receiving department, and carrying more than 200 parts of precious metals in 1000, or, in mint parlance, over 200 fine, and separates and refines the various metals contained therein, using electrolytic processes exclusively.

Bullion containing silver is treated in cells charged with a nitric electrolyte. These cells produce fine silver and leave a residue rich in gold.

The residue from the silver-cells, together with crude gold-bullion, is treated in cells having a chloride electrolyte. These produce fine gold and leave a residue containing silver chloride. The latter is reduced to the metallic state with zinc and is then treated in the silver-cells.

The various waste solutions and the wash-waters, after being freed from the bulk of their precious metals, still contain copper and other metals. These are removed by scrap-iron, and are then treated in the copper-cells, having a sulphate electrolyte. These cells produce pure copper, and collect a residue containing lead, some gold and silver, and all the metals of the platinum group that were in the bullion. This residue is relatively small, and is melted into bars and stored until sufficient accumulates to warrant treating it for platinum, etc.

The refinery occupies three large and three small rooms. The large ones are, a melting-room, 30 by 34 ft.; a cell-room, 39 by 46 ft.; and a wash-room, 30 by 33 feet. The small rooms are used as foreman's office, laboratory, and generator-room, respectively.

The methods here described are those in use in December, 1909, when notes for the present paper were taken.

Silver Refining.

The anodes are made up of crude silver bullion, together with gold bullion that is too low in gold to be easily made up into gold anodes. The endeavor is to make a mixture, such that the anodes will run about 600 thousandths in silver, 300 thousandths in gold and the remaining 100 thousandths in base metals. The metal is melted in Rockwell melting furnaces of the "open-top mint type" heated with crude oil.

The anodes are cast in open iron molds and are suspended in the solution by C shaped hooks of gold, which pass through the top of the anodes and over bars which form the conductors of the current. The anodes are immersed for the full length in the electrolyte.

The cathodes are made of sheets of silver, 1000 fine, 0.051 in. thick (No. 16 B. & S. Gauge) and 4 in. wide. They are immersed for 8.5 inches in the electrolyte, and are bent over at the top so as to hang from the conductors.

The crystallized silver that collects on the cathodes is loose and is removed daily. To facilitate this stripping, the cathode sheets are treated with a "dope", consisting of silver nitrate, copper nitrate, and hydrochloric acid, all mixed together and painted on with a rag The sheets are then dried in the drying-room. One dose of this dope lasts two or three

months; then the deposits begin to stick, and the plates are re-treated.

The electrolyte consists of water with 3 per cent. of silver, as silver nitrate, from 1.5 to 2.5 of free nitric acid, and a little glue. The latter is dissolved and poured in as a thick liquid. The effect of the glue is to toughen the deposit of silver on the cathode.

The electrolyte dissolves and retains the copper and other soluble base metals. These do no harm until the solution becomes so strong that the purity of the silver deposited on the cathodes is affected, when it has to be changed.

The cells are of brown earthenware. Experience has shown that they are too shallow for advantageous work. There is only a small space between the bottom of the cell and the lower end of the anodes, and the slimes that collect in this space soon cause short-circuits which stop the action of the cell. A new set of cells, 18 in. deep inside, instead of 12 in., is about to be installed. These deeper cells will allow longer cathodes to be used, and since the cores that have to be re-treated will be of the same size, there will be a reduction in the percentage of metal to be re-treated.

The cells are placed end to end in a double row on two long benches, 12 on one bench and 6 on the other. This allows all the cells to be easily inspected and attended to, from one side or the other of the benches.

The anodes and cathodes are hung in alternate rows from maple strips, 2⅛ in. apart from center to center, which extend across the cells. Along the top of each is laid a gold strip, bent into the form of an inverted trough. These gold strips are connected by screws alternately to the positive and negative bus-bars, and form the conductors. There are 19 of these across each cell, 10 supporting four cathodes each and 9 supporting four anodes each. The bus-bars are of copper and extend along the main wooden frame that covers the top of the entire bench of cells. All woodwork and the copper bars are coated with "biturine" solution, an asphaltic paint that comes from Australia, to protect them from the action of the acids.

The solution in the cells is kept in motion by two glass propellers in each cell. This prevents the heavier solutions from settling to the bottom, and makes the deposition uniform over the whole cathode.

Each propeller, 2 in. across, is made in one piece with a glass rod, which runs up vertically between the electrodes, and is driven by a cord running in a grooved pulley at its top. The vertical glass rods, as well as the line-shaft, are carried by a wooden frame above the cells, as shown in Fig. 6.

The current is a direct one of 15 volts, and passes through the 18 cells in series. The amount of current is such as to give a density of 8.3 amperes per square foot of cathode surface. There are 40 cathodes per cell and each has a normal immersion of 8.5 inches.

Centrifugal machines are used to separate the moisture from the different products of the refining process, and to wash them free from soluble matter. There are two of these machines. No. 1 belongs primarily to the silver process, and is used exclusively for silver or products charged with nitric compounds. No material containing chlorides is ever placed in it. Centrifugal No. 2 is similar to No. 1, but is reserved for the gold process and for solutions carrying chlorides.

The rotors of the centrifugals are of earthenware and provided with ducts for the escape of liquids. When in use, the rotor is lined with one thickness of 7 oz. duck, and in this bag is placed the material to be treated. A different filter bag is kept for each different kind of material to be washed.

All the products of the silver process can be dried sufficiently by the centrifugals, so that they can be transferred to the crucibles and melted.

Operation and Products

Briefly, the anodes are dissolved; pure silver collects on the cathodes; copper and other metals forming soluble nitrates go into the bath, and gold and other insoluble metals are left as a sponge on the anodes.

As the dissolving action progresses, the anodes are taken out at intervals and the sponge of insoluble metals is shaken off into an earthenware jar, by knocking them against its sides. This spongy material is crude or black gold with about 10 per cent. of silver and 1 per cent of base metals. After washing in centrifugal machine No. 2, it is melted into anodes for the gold process.

When the anodes are eaten down so that they barely hold together (which takes about 48 hr), they are removed, all the loose spongy material is knocked off, and the hard cores that remain are treated in the horizontal cells, to be described later. New anodes are then hung in their places.

So long as the electrolyte contains an ample supply of silver, this is deposited in preference to the base metals.

The electrolyte is tested at intervals to determine its strength in silver and if this test shows that the bath is too low in silver, its strength is brought up by adding strong silver nitrate solution.

When the bath contains about 8 per cent. of copper it has to be changed, since the silver deposited on the cathodes begins to be contaminated with the copper. This spent electrolyte is treated in the scrap-copper tank to recover the silver, and then passes on to the scrap-iron tank, where the other metals contained in it are caught, as will be described under the head of Copper-Refining.

The pure silver collects in a crystalline condition on the cathodes, which are lifted out daily and cleaned over large porcelain jars. At first, the deposit is loose and fern-like, and most of it can be removed by knocking the cathodes against the sides of the jars. Gradually a firmer deposit collects that will not knock off, and this has to be removed with a scraper, when it comes away in sheets and leaves the cathode entirely clean. This pure silver is washed in centrifugal machine No. 1 until free from acid and soluble salts, and then is whirled until dry enough for melting, when it is made into fine bars.

A second product of this process consists of the slime that accumulates in the bottom of the cells. This contains black gold that has dropped from the anodes, as they dissolved, also crystalline silver that failed to stick to the cathodes. This slime is transferred to the horizontal cell for re-treatment.

(In some plants the anodes are incased in cloth bags, and the black gold is caught before it can drop to the bottom, and is melted for gold anodes without further treatment.)

The operation in the horizontal silver-cells is the same as in the vertical, but the mechanical details are different. The anodes consist of the cores of the silver anodes from the vertical cells, the slime from the bottom of the vertical cells, and the silver reduced from the silver chloride slime of the gold cells. The cathodes consist of graphite plates on the bottom of the cells. The silver deposits on these plates and is removed at intervals with a hard-rubber dipper. The electrolyte is the same as in the vertical cells. The current is about 50 amperes and passes through the three cells in series. This gives a current density of 14.3 amperes per sq. ft. of cathode surface and requires a potential of 5 volts per cell, or a total of 15 volts.

The baskets are made of maple and treated with "biturine". No metal is used in their construction. The material to be treated is retained on five layers of 7 oz. duck placed in each basket and the edges are brought up on all sides above the top of the basket. The baskets are suspended in the electrolyte by cleats resting on the top of the cells.

The material left in the basket, after all the silver has been dissolved, is crude or black gold, and is transferred to centrifugal machine No. 1 and washed. It is then dried in the dry-room, melted, and used with other metal to make gold anodes for the gold process.

The spent electrolyte from both the vertical and the horizontal cells contains silver nitrate and the soluble nitrates of the base metals that were in the original bullion. These solutions and the nitric wash-waters from the centrifugal machine are passed over scrap-copper suspended in wooden tanks, which precipitates the silver and leaves the base nitrates in solution. These tanks are in the wash-room, as shown in Fig. 9.

The precipitated silver is washed and dried in centrifugal machine No. 1, and then is melted and cast into bars. These are added to melts of low-grade gold and made into silver anodes for the vertical silver-cells. At times, this precipitated silver has been dissolved in nitric acid to make silver nitrate for the electrolyte, but it is often impure, and a better electrolyte is obtained by dissolving pure silver; hence the practice is not common.

The solution containing the base nitrates is treated as described under the head of Copper-Refining.

Gold Refining

The anodes of the same size as the silver ones, are made from high grade gold-bullion, and crude gold-products from both the gold and the silver refining processes. They carry about 90 per cent. of gold and it is desirable that the silver-content be limited to about 7 per cent., since a greater amount interferes with the operations. Copper is less objectionable than silver. The anodes, hung by C-shaped hooks of pure gold from the conductors running across the top of the cells, are immersed 7.5 in. in the electrolyte.

The cathodes, strips of pure gold 4 in. wide by 0.012 in. thick (No. 28 B. & S. gauge), weigh about 4.5 oz. They are bent over at the top, so that they can be hooked over the conductors crossing the top of the cells. They are immersed to a depth of 6 in., and are allowed to remain in the cells until they weigh about 160 oz., when they are removed and used as the anodes for the second set of cells. By this re-deposition the fineness of the final product is raised to about 999.7.

The gold is deposited on the cathodes so tightly that stripping is impracticable, and when the final cathodes have been formed, the deposit with its original cathode sheet is all melted down together. Hence, the original strips have to be made of pure gold in order to maintain the quality of the product.

prevent this, the bath is tested daily to determine its strength in gold, and if found to be low, is restored to the desired standard by the addition of strong solution.

After a week, the electrolyte becomes spent and takes on a dirty dark green color, due to the accumulation of copper-salts in the solution. When it reaches this condition, the gold-deposit on the cathodes is soft, and the electrolyte has to be changed.

The gold chloride for the electrolyte is made by dissolving gold bullion in hydrochloric acid by means of the electric current. Anodes of gold 999 fine are hung in strong hydrochloric acid, in five cells slightly larger than those used for the gold refining process, and the cathodes, also of gold, are hung in porous cups filled with strong hydrochloric

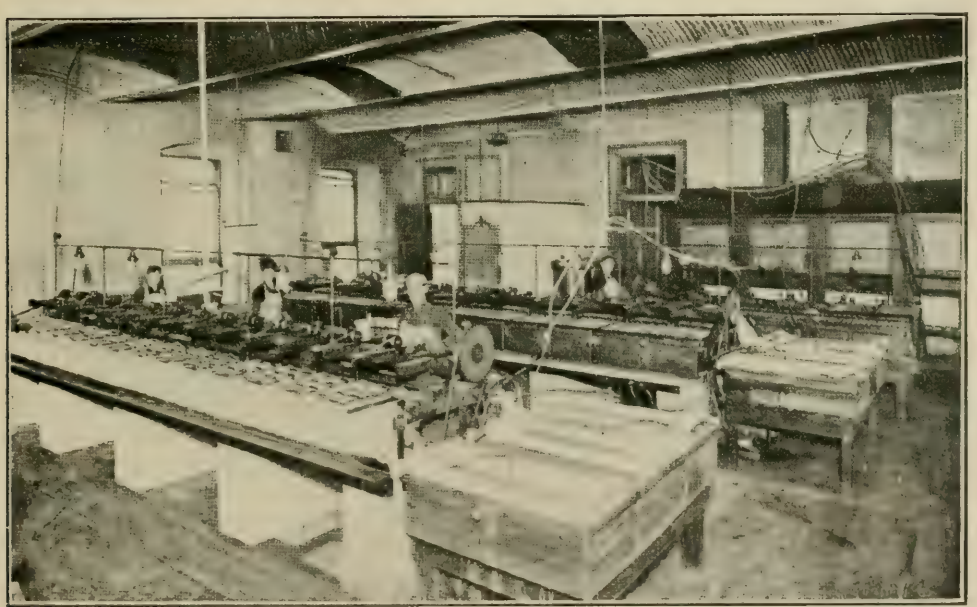


Fig. 2. Electrolytic Room of the San Francisco Mint.

The electrolyte is a trichloride solution, carrying in the first set of cells 70 g. of gold per liter, and from 10 to 12 per cent. of free hydrochloric acid, and in the second set, only 60 g. of gold per liter, but with the same amount of acid.

During the operation, the electrolyte decomposes and drops particles of metallic gold, which collect in the slimes. This lowers the strength of the solution in gold, and when it gets below 4 per cent. of gold, the deposit on the cathode is soft and tends to crumble. To

acid. On passing a current of 500 amperes at 25 volts through the cells, the anodes are dissolved, giving a solution of gold chloride in the cells; but, owing to the porous cups, there is no gold deposited on the cathodes, since hydrochloric acid fumes are liberated in the process, it is performed under a glass-inclosed hood connected to a flue. The gold chloride solution obtained from these cells has a strength of from 375 to 500 grams of gold per liter.

The cells are of white Royal Berlin porce-

lain. The electrolyte, like that in the silver cells, is kept in motion by one glass propeller in the center of each cell revolved by a vertical glass rod.

The cells are placed in two rows of 14 each, on a long bench. Those on one side form the first set, and those on the other the second set, for re-treating the cathodes formed in the first.

The space between adjacent cells is covered with a porcelain strip about 1 by 3 in. in cross-section, clamped to the rim of the cells, and having a series of notches to receive the porcelain bars which support the conductors across the tops of the cells from which the electrodes are hung.

There are three rows of anodes and four rows of cathodes in each cell. The rows of anodes alternate with the rows of cathodes, and are 2⅝ in. from center to center. There are two cathodes on each row, making eight cathodes per cell, and there are three anodes on each of two rows, but only two on the center row, making eight anodes per cell. The center anode is omitted to give room for the circulating propeller. The drive for the propellers is similar to that for the silver-cells.

To the copper bus-bars, which are bolted to the top of the porcelain strips between the cells, are screwed the ends of the conductors that extend across the cells. These conductors are gold strips bent into an inverted trough shape, and fit the top of the porcelain cross-bars. The electrodes hang from these conductors.

The current, a direct one of 15 volts potential, passes through the 14 cells of each set in series, requiring nearly 1 volt per cell. The total amount of current is 180 amperes. There are eight cathodes in each cell in parallel, each having an immersed area of 4×6 in $= 24$ sq. in. Four of the cathodes have both sides available for the reception of deposits and four have only one side available, thus making 12 cathode-surfaces of 24 sq. in. each, or a total of 2 sq. ft. The current being 180 amperes, the current-density is 90 amperes per square foot of cathode-surface.

Centrifugal Machine No. 2 is identical with No. 1, described under the silver process; but this one is used exclusively for gold-products and material charged with chloride waters, which would precipitate silver chloride if it came in contact with solutions of silver-salts. A different filter-bag is used for each kind of material.

The drying room is of brick and has an iron door. It is heated with steam and used to dry fine gold cathodes and other gold products before melting. The vats used for the precipitation of the gold from the spent electrolyte are made of brown earthenware and stand on trucks for convenience of moving them about. They are 2×4 feet and 2 feet deep. The tub used for reducing the silver chloride to metal, by means of zinc and sulphuric acid, is made of wood and lined with lead. It is 2×4 feet and 2 feet deep.

The anodes are dissolved in the electrolyte, and refined gold is deposited at the cathodes. All the metals in the anodes dissolve, including those of the platinum group, except the silver and some lead. The last two form chlorides and drop to the bottom of the cells as the anodes dissolve. About 10 per cent. of the anodes is left as undissolved tops and has to be re-melted.

It is desirable that the anodes should not carry more than about 7 per cent. of silver. When more than this amount is present, the coating of silver chloride that forms on the anodes is thick enough to retard the dissolving action. When the anodes contain less than 7 per cent. of silver, they can be treated in a single set of cells and the gold deposit on the cathode will be considerably more than 999 fine; but when more than 7 per cent. is present, so much silver chloride is formed at the anodes that, in dropping off, some of it is caught by the circulating current, and carried mechanically to the cathodes, where it clings to the rough surface of the gold deposit and lowers its fineness to less than 999. When handling such anodes high in silver, it has been found advisable to deposit the gold on the cathodes of one set of cells and then transfer these cathodes, after washing them, to a second set of cells, where they are used as anodes and the gold re-deposited almost pure.

The gold anodes are made exclusively from the gold from the silver-cells, which assays about 875 thousandths gold, from 100 to 125 thousandths silver, and a small amount of base metals. This gives, in the first cells, cathodes about 998.7 fine, which, on being re-treated in the second set of cells, produce gold about 999.7 fine. It has generally been considered necessary to boil the crude gold from the silver-cells with concentrated sulphuric acid before casting it into anodes for the gold-cells, in order to reduce the silver to

less than 7 per cent. The desire to do away with this acid treatment, and still produce a high grade of gold-deposit, led to the experiment of redepositing the first gold cathodes.

The same amount of current at the same voltage is used in both sets of cells. The electrolyte in the first set carries 70 g., that of the second set 60 g. of gold per liter. With the exception of this difference in the strength of the electrolyte, the operation in both sets of cells is identical.

cumulated in the solution by the dissolving of many anodes is quite appreciable, and is recovered as described later, under Copper-Refining.

The silver in the anodes forms at the anodes insoluble silver chloride, a part of which, in the first set of cells, is removed at intervals by taking out the anodes and brushing and jarring off the silver chloride into an earthenware jar. Most of the silver chloride, however, drops to the bottom of the cells.

Fig. 3. Centrifugals for Drying the Sponge Silver and Gold.

The gold cathodes from the second set of cells are carefully washed in a porcelain filter, dried in the dry-room, melted and cast into fine bars about 1,000 oz. in weight, which may be sold as "mint bars," or alloyed with copper and made into coins.

The copper in the anodes goes into solution in the electrolyte; and as long as the proper amount of gold is maintained in the solution, it does no harm until the amount reaches about 4 per cent., when the gold begins to deposit soft and falls from the cathode. Then the electrolyte has to be changed.

The metals of the platinum group also dissolve in the electrolyte; and while they occur in such small quantities in the bullion that they can hardly be detected, the quantity ac-

The slime in the bottom of the cells also contains metallic gold, which comes from the decomposition of the electrolyte, and does not deposit on the cathodes. This decomposition of the electrolyte seems to be due to the displacement of its gold by the copper dissolved from the anodes. In the first set of cells, with anodes containing 10 per cent of silver, the slimes are about 600 thousandths gold and 300 thousandths silver, and in the second set, with anodes almost free from silver, they are 906 thousandths gold and only 40 thousandths silver.

The slime from the bottom of the cells, and the silver chloride that has been removed from the anodes, are washed free from soluble chlorides in centrifugal machine No. 2, us-

ing hot water in order to carry off the lead chloride, and are treated in a lead-lined tub with granulated zinc, which precipitates the silver in a metallic condition, the zinc becoming zinc chloride. The granulated zinc is stirred into the mass of silver chloride and a little sulphuric acid is added to start the reaction. At first, the wet slime is a gelatinous mass characteristic of silver chloride, but as the reaction progresses it becomes more and more gritty. The mixture is tested, towards the end of the process for the presence of silver chloride, and when there is no longer any present, sufficient sulphuric acid is added to dissolve the zinc that remains.

The granular silver with its gold content, after being washed in centrifugal machine No. 2 to remove all soluble salts, is transferred to the anode basket of the horizontal cells of the silver process for the recovery of the silver; and the gold is afterwards obtained from the basket residue.

The wash-waters from the slimes and from the gold cathodes, together with the spent electrolyte from both set of cells, are placed in earthenware vats, and a concentrated solution of ferrous sulphate added to the liquid. This precipitates the gold which is allowed to settle by long standing. The liquor, which still contains platinum, copper and iron salts, is decanted and sent to the scrap iron tank for further treatment, as described later under the head of Copper-Refining. The gold that remains after decantation is washed and dried in centrifugal machine No. 2, melted with low-grade bullion and cast into anodes, in which form it re-enters the process and is re-treated.

Copper-Refining.

This process is used at the San Francisco Mint to work up the copper occurring as base metal in the bullion, and to recover the copper used to precipitate the silver from the various wash-waters. It is similar to the commercial process of copper-refining; but it is of special interest here, because the metals of the platinum group, taken into solution in the previous operations, have now accumulated in sufficient quantities to be recovered.

The wash-waters and spent electrolyte from all parts of the refinery, from which the gold and silver have been recovered, are sent to the scrap-iron tank, and there deposit their copper, lead, and any precious metals, including those of the platinum group, that have escaped from the previous operations.

The sludge of cement-copper from this tank is washed and drained in wooden tubs with filter bottoms, whence it is transferred to other filter-tubs and allowed to air-dry, and then is melted down and cast into anodes for refining.

The copper anodes contain lead derived from the silver-bullion, metals of the platinum group derived from the gold-bullion, and small amounts of gold and silver. They are 5 by 14 in. by ⅜ in. thick, and are immersed 13 in. in the electrolyte.

The cathodes are started on sheets of lead 3.75 by 15 in., and when both sides have been coated with a copper-deposit of sufficient strength, the copper is stripped off the lead and returned to the cells. This does away with the repeated melting and rolling of sheet-copper cathodes, similar to those of the precious metals used in the gold and silver processes. The cathodes are immersed 11 in. in the electrolyte and receive deposits on both sides. When completed, these cathodes are washed free of the electrolyte, dried, and added to melts of coin-metal, without previous melting into bars.

The cells are lead-lined wooden boxes, 3 by 1.5 ft. by 1.5 ft deep. Each cell contains 23 anodes and 34 cathodes, hanging in alternate rows, 2 in. apart from center to center.

The electrolyte is copper sulphate and contains 3 per cent. of copper as sulphate and from 3 to 4 per cent. of free sulphuric acid. The cells are placed in a series of steps, so that the electrolyte flows through them by gravity. A steam-ejector lifts the electrolyte from the sump at the lower end and returns it to the head tank, from which it again flows through the cells.

The current used is direct and has a density of 10 amperes per square foot of cathode-surface, and a potential of 3.6 volts, which is equal to 0.6 volt per cell.

The gold, silver, and metals of the platinum group are insoluble in the sulphate electrolyte, and drop to the bottom of the cells as slimes when the anodes are dissolved. These slimes are collected, washed with dilute sulphuric acid, dried, and melted into bars. These bars are stored until sufficient have accumulated, when they are treated for the separation of the various precious metals, especially those of the platinum group, that they contain.

The Advantage of a Cyanide Zinc Solution for Some Classes of Work.

The ordinary electrogalvanizing solution composed of sulphate of zinc is used for the following reasons:

1. It is cheap.
2. It is capable of giving a heavy deposit of zinc in a short time.

Until the sulphate of zinc solution was used, electrogalvanizing was not employed at all, although for many years it had been known that zinc could be deposited from a cyanide solution quite satisfactorily. The expense of the cyanide and the comparative thinness of the zinc deposit prevented the adoption of the cyanide solution, but as soon as the sulphate of zinc bath became understood so that it could be employed in a commercial manner, electrogalvanizing became a commercial process and is now extensively used.

The sulphate of zinc solution, as now employed for electrogalvanizing, is quite satisfactory for the majority of work that has to be electrogalvanized. For that which cannot be electrogalvanized by it, it is usually assumed cannot be coated with the zinc. It is in such instances and upon such work that the cyanide zinc solution can be used with success. It should not be assumed that the cyanide zinc solution can be used on all work that cannot be electrogalvanized with the regular sulphate of zinc solution for the cost may be such as to prohibit its employment, but there are many instances, no doubt, in which it may be of assistance.

One disadvantage of the sulphate of zinc solution is that it does not "throw" the zinc deposit well. By this is meant that in deep portions or pockets of the article being electrogalvanized, the zinc does not deposit. This feature is not only characteristic of sulphate of zinc solutions, but sulphate of copper as well. It is well known that cyanide solutions "throw" metal better than any others. It is to this fact that the value of a cyanide zinc solution belongs. It will "throw" zinc into portions of an article that cannot be reached by the deposit from a sulphate of zinc solution.

Let it be understood that a cyanide zinc solution is not recommended except in extreme cases where it is the only remedy, but in such instances it will be found of considerable value as it will enable a plater to deposit zinc in deep portions of an article otherwise impossible. Many specifications for iron or steel goods now call for electrogalvanizing as a coating and instances are frequently encountered in which it becomes impossible to comply with the specifications on account of the zinc not "throwing" into the deep portions in the regular sulphate of zinc bath. In such cases, the cyanide zinc solution can be employed with excellent results and the articles electrogalvanized according to specifications without much extra cost.

The cyanide zinc solution should be made strong so that it will deposit metal rapidly. The following is a good solution and has been employed with satisfactory results:

Water ..... 1 gallon
Cyanide ..... 1 lb.

.. Dissolve the cyanide in the water and then add to it *all* the carbonate of zinc it will take up. Make sure of this point as there should be no excess of cyanide. The plastic carbonate of zinc dissolves more readily than the dry and should be used if possible. In making up this first solution there should be no excess of free cyanide and no excess of carbonate of zinc. The object is to dissolve all the carbonate of zinc in the cyanide that it will take up, but yet have no excess of the carbonate. This point is easily noticed by the eye.

Now add to this zinc solution, made up as directed,

Cyanide ..... 5 oz.

This is for free cyanide and will serve to keep the anodes clean.

It is believed that this method of making up the solution is as simple as can be desired and eliminates any uncertainty arising from the variable strength of the cyanide and the carbonate of zinc. When carried out, the solution will always be uniform and accurate. The same method should be used in making up other cyanide solutions, such as those of copper or brass.

While this cyanide zinc solution can be used cold and seems to give very good results in this condition, it is advisable, whenever possible, to heat it to about 150 degrees F. The zinc deposits better and more rapidly, and less voltage will be needed. One great advantage of such a hot cyanide zinc solution is its power of removing grease and oil from the work. Gas is given off from the work freely

and the solution thus acts as an electric cleaner and deposits zinc at the same time. Oily screws, nails and other commercial articles may be coated with zinc, if free from rust, without cleaning, although it is always advisable to previously clean them to avoid contaminating the solution. Very careful cleaning, however, is necessary.

The zinc deposits well with a low or high voltage, but if too strong a current is employed the deposit will be burned. From 3 to 4 volts give good and rapid results in a cold solution and about 2 volts are all that are required in the hot solution.

The cyanide zinc solution is not to be recommended for regular work, but, as previously mentioned, it should be employed only as an accessory in cases where the sulphate solution cannot be used. In such instances it will be found of much value.

An Improved Rouge.

An improved rouge has been patented by Peter Fireman of Washington, D. C., and for which he claims considerable superiority over the ordinary rouge for the polishing of gold, silver and platinum. The dry rouge is also employed for glass polishing.

The base of the rouge is ferro-ferric oxide and which is in the precipitated form. The inventor calls this material: "precipitated, black magnetic ferro-ferric oxide". For polishing metals the following composition is recommended:

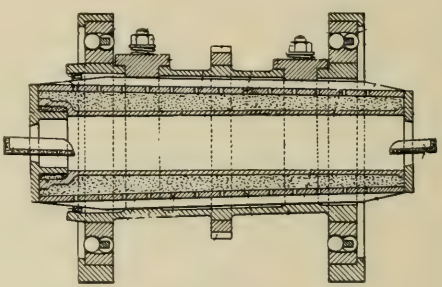
Ferro-Ferric Oxide	100 lbs.
Stearic Acid	17 lbs.
Beef Tallow	3 lbs.

The stearic acid and beef tallow are melted and the oxide stirred in and the mass made into sticks.

It is stated by the inventor that to gold and silver this polishing composition imparts a luster "particularly acceptable to the eye" which is not imparted by other polishing agents. To platinum it also imparts a luster not found without other polishing mediums. A small quantity of ordinary red rouge may be mixed with the composition in case it is desired to alter the "color" of the polished surface.

A Mold for Casting Pipes and Tubes by Spinning.

A mold for casting metals by centrifugal motion so that a pipe or tube shell will be obtained has been patented by Herman J. Molinder of Söderhamn, Sweden. The feature of this mold lies in the fact that it rests on ball bearings so that it can readily be revolved. The mold itself is in the center and a lining



Spinning Mold.

of sand is packed between the ball bearing cages and this mold. Very little heat is thus lost and the bearings do not heat. The mold may also be made of sand, and in this case the chill shell inside is not used.

The metal is poured in while the mold is being rapidly rotated or spun by a motor or belt, and forms a pipe or tube while cooling.

New Books.

TECHNICAL ANALYSIS OF BRASS, And The Non-Ferrous Alloys; by William Benham Price and Richard K. Meade. This book will fill a gap in non-ferrous literature and chemists and others, who contemplate the study of analytical chemistry, cannot fail to appreciate the compilation of the standard methods to be found in this work. The authors of the book are well fitted for the undertaking. Mr. Price is the chief-chemist for the Scovill Mfg. Co. of Waterbury, Conn., one of the largest brass rolling mills and manufacturers of brass goods in the United States. Mr. Meade is director of the Meade Testing Laboratories of Allentown, Pa.

The book contains methods for the complete analysis of the brasses, bronzes, German-silvers, babbitt-metals, solders, britannia metals, ingot copper, spelter A description of

the necessary apparatus is also given. The method for the analysis of the special alloys, such as phosphor-bronze, manganese-bronze and similar alloys is fully described. The book contains 267 pages with 17 illustrations. Size, 5 x 7½ inches, cloth bound. *John Wiley & Sons, New York City, publishers. Price, $2.00.* Copies supplied by THE BRASS WORLD PUBLISHING CO., postage paid.

HENDRICKS' COMMERCIAL REGISTER of The United States for Buyers and Sellers. *S. E. Hendricks Co., 74 Lafayette St., New York City.* 20th Edition. 1419 pages. Price $10.00. Prepaid to any part of the United States. This very useful work is now in its 20th. edition and every previous one has proved of the utmost service to the buyer and seller. There is nothing so annoying to a buyer as to find that he is without a list of the manufacturers of a certain article. Manufacturers are also annoyed when they cannot discover who the users are of their products. This book will assist them both. From it accurate lists of any line may readily be found and such lists, as well known, are difficult to obtain elsewhere. No manufacturer can afford to be without it. Not only is the book trustworthy but almost exhaustive. Going through so many editions has resulted in elimination of errors and omissions, additions of new names and a more extensive classification. This book never fails to give satisfaction and pays for itself in a short time. A new customer may be obtained from it and this alone is usually worth many times the cost of the book.

Sal-ammoniac is advantageous in a nickel plating solution for the reason that it increases the conductivity, and also, by the liberation of chlorine at the anode, causes the nickel in it to dissolve in the solution more readily.

Nickel salts, both double and single, are now made from the oxide of nickel, by dissolving in sulphuric acid, thus avoiding the use of nitric acid. The old method was to dissolve metallic nickel in nitric acid, evaporate with sulphuric acid to remove the nitric acid, and then crystallize. The removal of the last portions of the nitric acid is quite difficult and the nickel salts thus made usually contain traces of it which interfere with the electrodeposition by producing a dark, non-adherent nickel deposit.

A Novel Method of Making Copper Coated Steel Wire and Sheet.

A new and novel method of making copper coated steel sheet or wire has recently been patented by Henry W. Fisher of the Standard Underground Cable Co., of Pittsburgh, Pa. The advantage of cheapness of such copper coated steel has always been appreciated and many experiments have been carried out and much time spent by investigators in the endeavor to perfect such a process. Many and, in fact, the great majority of the processes have been failures. The usual method is to dip the steel billet in molten copper or to pour the

FIG. 1

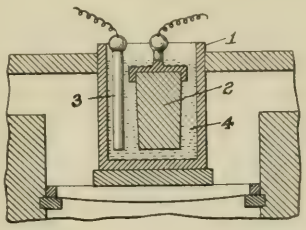


FIG. 2

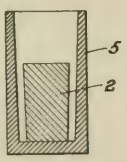
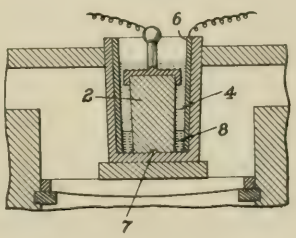


FIG. 3.



Sketch Showing Method of Depositing the Copper.

copper around it. Under such conditions, however, the copper does not adhere well and separates from the steel when the billet is rolled. Electroplating in the ordinary way has also been tried, but this also strips when the billet is rolled.

In the method herein described, the steel billet is electroplated but not in an aqueous solution; but instead a bath of a molten copper salt is employed. In this manner, it is claimed, the copper attaches itself firmly to the steel so that when rolled it does not peel

off. The method of carrying out the electro-deposition of the copper on the steel billet is as follows:

A graphite crucible is used for the vessel and, if desired any other refractory receptacle may be employed. The graphite, however, is preferable for the reason that it also acts as an anode, while if another kind of vessel is used, a separate anode must be employed.

In the crucible is placed a suitable quantity of borax and allowed to melt. It is stated that borax has been found quite suitable for the purpose and is a solvent for the copper salts subsequently introduced. Sodium chloride or other salts of a similar nature may also be used, but the inventor states that they are not as satisfactory as the borax. When melted, copper chloride is introduced into the borax and forms the substances from which the copper is deposited. As no copper anode can be employed, it is necessary to replenish the bath from time to time with the copper chloride in order to make up for that deposited. The temperature of the bath is kept at about that of molten copper or 1913°F. The illustrations herewith shown indicate the method of carrying out the deposition of the copper on a steel billet for the purpose of making wire by rolling in the ordinary way and then drawing through dies.

Figure 1 is a sectional view of a cell in which electrolysis is taking place. In this case, 1 represents the cell, 2 the body or core to be plated, 3 the anode, and 4 the electrolyte. It will be understood that the operation is progressing at the temperature at which copper melts.

Fig. 2 shows, in vertical section, a mold 5 within which the iron body 2, previously electro-plated in a cell such as illustrated in Fig. 1, is placed, with the desired space between the body itself and the mold wall, and into this space molten copper is teemed, displacing, in my preferred arrangement, a body of molten flux, as borax.

Fig. 3 shows in vertical section a chamber serving both as an electrolysis cell and as a mold. In this case, the cell is preferably lined with graphite as indicated at 6, the graphite lining forming the anode in electrolysis. The body of metal 2 is suitably placed within the chamber, and to that end may be centered upon a centering pin, as 7. The initial part of the operation consists in the electro-plating of the body of iron 2, in the manner and at the elevated temperature already described, and the following operation consists in teeming molten copper into the space between the body 2 and the graphite wall 6; in this second operation, it will be understood that the electrolyte 4 is gradually displaced by a body of molten copper, 8.

The copper is deposited on the billet only in a thin coating as it would not adhere in a thick coating at the melting temperature. The object is to obtain an intimate contact between the steel and copper so that when rolled the two will not separate.

When the desired thickness of copper has been deposited on the billet by means of the electric current (and it may be said in this connection that the current is passed through the molten bath as though an aqueous solution were had,) it is removed and put through a second operation in order to produce a heavy coating of copper. This second operation is carried out in the following manner:

The copper coated steel billet is placed in a mold and molten copper poured in so as to produce the necessary thickness on the outside. In order to have the copper adhere to that on the billet borax is placed in the mold and the copper poured into it. The borax in this case is melted.

A steel billet is therefore obtained, which is coated with copper so that when rolled into a rod and drawn into wire it remains intact and does not strip or peel. Bronzes of various kinds may also be used in place of the copper when desired.

Crucible Tongs Made from Steel Castings.

The average brass foundry uses a number of different sizes of crucible and this necessitates having on hand a variety of tongs which will fit them. Forged crucible tongs, while very satisfactory, of course are rather expensive and few brass foundries possess the number that they should have for carrying on their work as it should be done. In addition, shanks and various other forged steel foundry appliances are often wanting.

An innovation in the shape of cast-steel crucible tongs has recently been started by the Eastern Steel Casting Company, 30 Kemble St., Boston, Mass. This company are makers of high grade crucible steel sand castings, and recently found that crucible tongs could be made of castings much more expeditiously

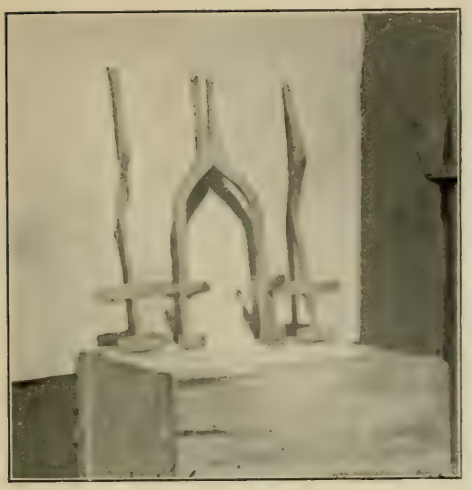


Fig. 1. Tongs as Cast.

than by forging. They have been making such tongs for some time.

The tongs are made by casting in sand from a pattern so that any desired shape can be made. In Fig. 1 are shown the tong ends in the manner in which they are cast, and in Fig. 2 these ends welded to the old handles and shaped to fit the crucibles are illustrated.

The Eastern Steel Casting Company supply the tongs or cast from patterns supplied by the customer. The tongs, of course, are made of steel of a quality suitable for use on brass melting crucibles.

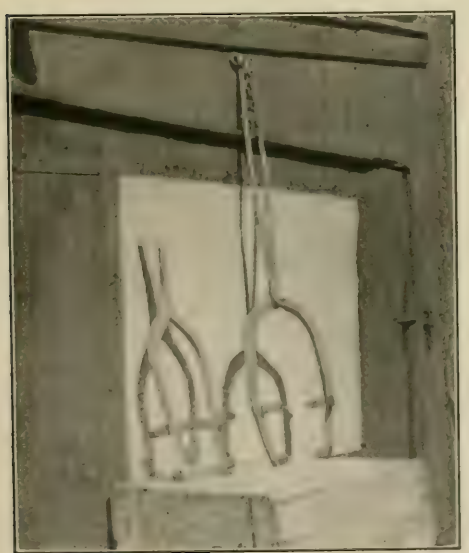
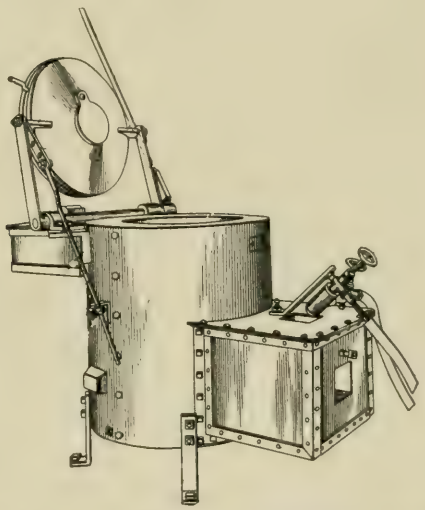


Fig. 2. Handles Welded on the Cast Ends.

An Improved Furnace Cover.

The usual furnace cover, employed on a crucible furnace, either is thrown back by means of a hinge, or moved to one side by a pivot device. Both are open to objections. The cover which is thrown back by the hinge, has the hot bottom facing the melter when he pulls the pot out or desires to put in more metal or stir it. The pivot device takes up considerable room and furnaces cannot be placed together.



New form of Cover for the "Steele-Harvey" Furnace.

A new form of furnace cover has been patented by David R. Steele of the Monarch Engineering & Mfg. Co., of Baltimore, Md., the well known manufacturers of the "Steele-Harvey" oil melting furnaces. In this form of cover, the hot bottom is turned away from the melter so that he is not subjected to the fierce heat that is thrown out when the bottom is towards him. In Fig. 1 and 2 the cover is illustrated and the method of operating may be understood. When used on furnaces, this cover allows ample room all around the outside for free working.

Wood tanks should be used for holding nickel plating solutions as iron or steel tanks are readily attacked unless great care is taken to keep them well coated with pitch. This is extremely difficult to do when the tanks are in constant use.

Questions and Answers.

QUESTION No. 1055. Why is it that a composition, composed mostly of lead, is so difficult to gold plate? On the other hand, a composition composed mainly of tin takes the gold deposit well. Were it not for the unsatisfactory gold plating on the lead mixture we would use it.

Answer. Lead does not take a gold deposit well for two reasons: First, it is a poor conductor of electricity. Second, it oxidizes very readily so that the surface is not in a good condition to take the gold deposit. These difficulties, however, are surmounted by first giving the article a flash copper deposit and then depositing the gold over it. The copper is deposited from a hot cyanide copper solution rather weak, standing about 4 or 5 degrees Beaumé.

QUESTION No. 1057. In galvanizing iron or steel is it always necessary to pickle it before immersing it in the spelter kettle. It has been noticed that this is always done and presume that it is a necessary operation. It has occurred to me that possibly some other cleaning method might answer.

Answer. Before iron or steel can be galvanized, the surface must be made clean and free from rust or scale or the zinc will not adhere. Pickling is used for the purpose of cleaning it. It is the cheapest method and, therefore, is extensively employed. Sand-blasting is also very efficacious and, in fact, any method, such as polishing or tumbling, which will produce a clean surface, will answer. The reason that pickling is used is because it is cheap and large quantities may be treated at a time.

QUESTION No. 1058. We have sent you a casting composed of copper and tin, with a little zinc (88-10-2 mixture) and you will notice that on the portion near the gate there are a lot of fine lines. These lines seem to penetrate the casting and will not machine out unless a very heavy cut is taken on the lathe, so much, in fact, that the castings are then too small. As we use new metals entirely, we are at loss to find the cause and so far have not been able to overcome the trouble. How can it be avoided?

Answer. Your difficulty is that you are pouring your metal too cold. Copper and tin mixtures must be poured "hot" in order to overcome the wavy appearance. These waves are the oxide which goes in with the metal. If you will notice, you will discover that when the bronze is poured "cold", the stream of metal is covered with oxide, which breaks off and passes in with the metal. When poured "hot", however, this does not seem to occur. You will have to determine just the right heat as the character of the casting will determine it. An excessive heat is as bad as one too "cold".

QUESTION No. 1059. What is the best method of polishing and buffing aluminum castings?

Answer. You can polish or cut-down the aluminum on a sand buff in the same manner that spelter or other soft metal castings are polished. The buffing is then done on a hard rag buff with some white polishing composition like Vienna-lime. Rouge should not be used for the reason that aluminum castings are always more or less porous and the dark buffing composition will fill the pin-holes and become conspicuous. With the white buffing compounds, this is not so apt to occur.

QUESTION No. 1063. Can gray iron castings be made by melting the iron in a graphite crucible in a brass founders' furnace? We desire to make some very fine gray-iron castings for dies and have no facilities for melting the iron other than the crucibles, and have not been able to obtain the necessary quality of molding on the dies in any of the regular iron foundries.

Answer. If you have a good strong draft to your furnaces you can melt the iron, otherwise you will not be able to do it. By the use of a light blast on the fire you will be able to melt the iron, however, and obtain it sufficiently hot for pouring the castings. You will be able to obtain good castings by melting the iron in the crucible and it is frequently done. Owing to the cost, however, it is not generally employed unless in an emergency or instances such as your own.

QUESTION No. 1064. I am having trouble with the steam-pipe in my copper vat. A coil does not last more than two or three weeks before holes appear in it. What is the trouble? The solution is a hot, cyanide copper.

Answer. You do not say of what the pipe is composed but presume it is of copper or brass, or possibly lead, or it would not be attacked. You should use an iron pipe as this is not attacked appreciably and is the cheapest material you can use. It is attacked less than any other metal.

QUESTION No. 1067. We have sent you a wrought-iron chain link we brass plated and sent out to a customer who has now returned it in the condition you see it. There seems to be spots on it of apparent rust. When sent out the link was plated well. Was the cause of the discoloration some substance that came in contact with the link while in the hands of the customer, or was it our own fault?

Answer. An examination under the microscope shows that the cause of the difficulty was blistering of the brass deposit during plating. Blisters form readily on a brass deposit when the surface is not clean, too much free cyanide is in the solution or too strong a current is used. The latter is the usual cause. The blisters hold solution under them and it gradually works out, corroding the surface and producing spots. It may take some time to work out and this is why the spotting does not occur immediately.

QUESTION No. 1068. Is it ever customary for rolling mills, which roll brass sheet, to clean the oil from their sheet metals before shipping to their customers? We have understood that it is now being done in some of the mills in Connecticut.

Answer . Up to the present time it has never been customary for brass rolling mills to clean the oil from their brass sheet as it has never been necessary, nor has it been now. The cleaning of oil from some kinds of brass sheet before annealing, has been tried but we do not know that it is being carried out as general practice. The object is to remove oil before annealing so that it will not cause stains. It is now well appreciated that oil causes stains, commonly called "pickle stains" as they appear only after pickling. The removal of the oil from the metal (all brass sheet must have oil on it when rolled) causes clean, uniform sheet to be obtained after annealing and pickling. The only advantage, however, is in the appearance as the sheet is not improved otherwise.

QUESTION No. 1069. What can be used for cleaning copper punchings so that they may be soldered by dipping them in molten solder? We cannot get the solder to adhere although we use a flux and good solder.

Answer. Your difficulty apparently is that your copper is not bright. To be soldered, all metals must be bright. First, clean the grease or oil from the copper by an alkali solution (caustic potash or other suitable cleaner) and then dip, after rinsing into the following acid dip:

Sulphuric Acid	1 gallon
Nitric Acid	1 gallon
Water	1 quart

If this dip acts too rapidly, add less water, but if the acids are full strength and the dip is not hot it will probably give you what you want, a bright, clean copper surface that will "take" the solder uniformly. Use chloride of zinc for the flux.

QUESTION No. 1070. We would thank you to inform us if it is customary for mills and cutting-up shops to melt their aluminum scrap and use it over again for rolling into sheet? Or is it impaired by the process of melting to such an extent that it must be used for castings?

Answer. Owing to the oxidation of the aluminum scrap when melted it is impossible to roll such cast metal into sheet again without cracking. This is individually caused by the lightness of the oxide of aluminum which intermingles with the molten metal and does not float to the top readily. It becomes so scattered in the metal that it acts like dirt and prevents the cohesion of the particles of aluminum with the result that, when rolled, the metal cracks. It is customary to use the scrap aluminum for making sand castings.

QUESTION No. 1071. We are using a hand enamel on cheap jewelry. The base is copper and we then silver plate it, after which the hard enamel is baked on. The enamel should come white, but it occasionally comes yellow as you will notice from the same we sent you. We are at loss to understand why this should come in this manner as the enamel and methods of firing are always the same.

Answer. Your trouble lies in the silver plating, as an examination of the sample sent indicates. The silver has stripped or peeled from the copper base so that the enamel has come in contact with the copper and has become colored yellow by it. Just what caused the silver to peel we are unable to ascertain without more investigation, but either the copper was not clean, or you did not use a "strike" solution previous to going into the regular silver bath. You can readily ascertain which of these obstacles is the one, or possibly both may be the cause.

QUESTION No. 1072. I have a large quantity of aluminum automobile hub-caps to make and they are to be threaded on the inside and turned on the outside. I am using an aluminum mixture composed of 1 lb. of copper to 11½ lbs. of aluminum, but find it too soft to thread or turn easily. The mixture has a good color, but something must be used which threads better. What is the best aluminum mixture for this purpose?

Answer. The aluminum and copper mixture that you are using does not cut or thread as well as some of the other mixtures containing zinc. While zinc is not a good ingredient in a mixture for large aluminum castings on account of the danger in cracking, it can be employed for small work with good results, particularly if the casting is to be machined. Use the following:

Aluminum	82 lbs.
Zinc	15 lbs.
Copper	3 lbs.

You will find this mixture to cut and thread much better than the aluminum and copper one. More copper than the 3 lbs. will render it harder and also more brittle.

QUESTION No. 1073. Can a cyanide copper solution be made to work uniformly at all times; or will it have to be constantly "doctored" to make it work even?

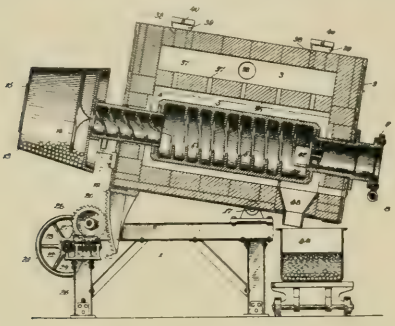
Answer. A cyanide copper solution, if carefully made, should work very uniformly. If you work it "hard" and it is run hot, it will deteriorate more rapidly than when used cold. The reason for this is that the cyanide of oxidized to cyanate and to the carbonate of potassium. In order to offset this, it is customary, when a hot cyanide copper solution is used, to throw away a small amount of it each week and replenish with a new solution. If, however, your solution is run cold and not forced, it should work in a very uniform condition for a long time.

QUESTION No. 1076. In casting zinc in metal molds, what is the cause of its cracking? We have found that nothing but high grade spelter can be employed. Ordinary spelter cracks every time.

Answer. The cause of the cracking is the lead in the spelter. Iron does not seem to cause it to any extent, and the refined spelter contains the minimum amount of lead. The lead may be said to be the cause of the trouble.

Patent Abstracts.

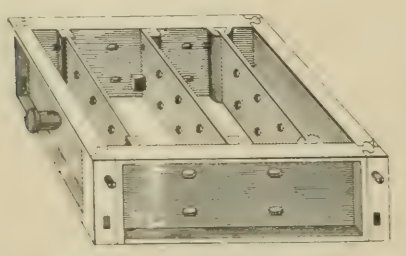
1,007,021, Oct. 24, 1911. ANNEALING FURNACE. Edward S. Davis of Jersey City, N. J. Assignor to the Rockwell Furnace Co., of New York City. A rotary annealing furnace for the automatic annealing of small



metal articles. The interior of the furnace has a screw formed in it and as the whole revolves during the annealing, the articles being treated are moved along and finally dumped in a finished state. The furnace may also be used for bluing and hardening.

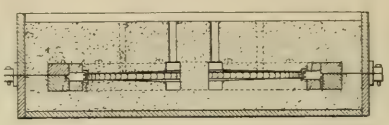
1,005,022, Oct. 3, 1911. PROCESS OF DETINNING TIN-SCRAP. Karl Goldschmidt and Josef Weber of Essen-on-the-Ruhr, Germany. A method of detinning tin-plate scrap by means of chlorine gas. The feature of the patent lies in making the scrap in the form of thin bundles and placing them in the receptacle, for the action of the chlorine, with the laminae of the scrap running downwards. This allows the stannic chloride formed by the action to drain off readily and which cannot be done in large, compact bundles of scrap placed in an irregular manner.

1,005,369, Oct. 10, 1911. MOLDING FLASK. John Tuohy of Black Diamond, Cal. A molding flask so constructed that the size



may be changed as desired to suit different shape patterns. This is accomplished by the use of movable sides.

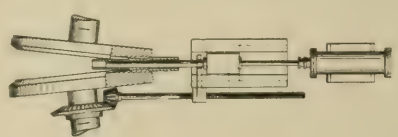
1,005,736, Oct. 10, 1911. PROCESS FOR MANUFACTURING TURBINE BUCKET WHEELS. James Wilkinson of Providence, R. I. A process for casting the buckets on turbine wheels so that the time and labor necessary in fitting after the usual fashion is obviated to a certain degree. The buckets are



rammed in the mold and metal poured around them. The inner ends of the buckets are perforated so that the metal will hold securely. In order to render the metal extremely fluid, the use of "Thermit" is claimed in the patent to superheat it before pouring. The process is applied to the manufacture of steam-turbine wheels.

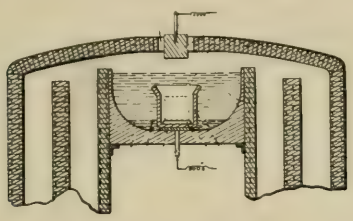
1,005,007, Oct. 3, 1911. METHOD OF TREATING MOLDS USED IN THE ART OF ELECTROTYPING. George E. Dunton of New York City. A process of removing grease and oil from a wax mold used in electrotyping. The wax mold is placed in a vessel and allowed to soak for about seven minutes in the following solution: Methyl alcohol 9 parts; chlorine water 3 parts; saturated solution of common salt in water 2½ parts; hydrochloric acid ½ part. The mold is then treated with black-lead in the usual manner. It is claimed that the wax, from which the grease has been removed, will produce electrotypes with finer detail than by the use of untreated wax.

1,005,091, Oct. 3, 1911. APPARATUS FOR THE MANUFACTURE OR PRODUCTION OF WELDLESS OR SEAMLESS METAL TUBES. Charles F. Williams of Erie, Pa., and William Dicks of Dumbarton,



Scotland. A process of making seamless metal tubes by rolling on a mandrel by means of conical rollers. The feature of the invention lies in the manner in which the rolls act on the billet while the rolling is taking place.

1,004,673, Oct. 3, 1911. PROCESS OF AND APPARATUS FOR MAKING CLAD METALS. John F. Monnot of New York City. Assignor to the Duplex Metals Co., of New York City. A process of making copper coated steel billets. The steel billet is placed in a bath of a flux, such as fluor-spar, borax or

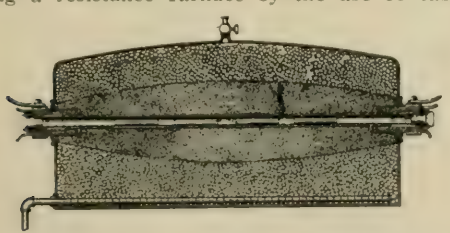


similar material which will melt. In this is dissolved a copper salt and the steel billet made the cathode while an electric current is passed through. The copper deposits on the billet and adheres firmly. A suitable thickness of copper is then cast on. Other metals may be used instead of copper.

1,006,459, Oct. 24, 1911. APPARATUS FOR AUTOGENOUS METAL-WORKING. Wilhelm Brandes of Gottenberg, Sweden. A burner for oxy-acetylene gas and which is so constructed that it may be used for both welding and cutting with interchangeable nozzles and also preventing the conduction of excessive heat to the main body of the blowpipe.

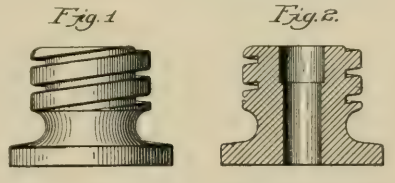
1,006, 681, Oct. 24, 1911. MOLDING MACHINE. Eugene Ronceray of Paris, France. The machine is so designed that the flask does not have to be locked and unlocked, as in the turn-over machine, stripping places and high patterns may be used, and great accuracy in the drawing of the pattern is had.

1,004,557, Oct. 3, 1911. RESISTANCE FURNACE. William D. Coolidge of Schenectady, N. Y. Assignor to the General Electric Co. of the same place. A method of making a resistance furnace by the use of tube



tungsten surrounded with resistance material such as magnesia. Means are used for passing an inert gas through the tube while the heating is taking place, in order to protect it against oxidation.

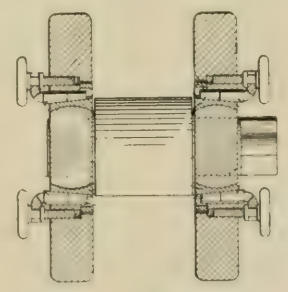
1,004,763, Oct. 3, 1911. METAL SPINNING MACHINE. Daniel P. Fitzgerald of Newark, N. J. A device for use on metal spinning machines so that a cup-shaped blank may be reduced to the required article such as a collar-button, cartridge or a similar arti-



cle. The device is so made that pressure on the metal is exerted in two directions as in hand spinning. For this reason it is possible to produce articles by spinning that cannot be made on spinning machines exerting the pressure in one direction only.

1,004,251, Sept. 26, 1911. MACHINE FOR COATING WIRE. George Gustave of Chicago, ill. Assignor to the Western Electric Co., of the same city. A machine for coating wire with enamel. A number of wires are handled at the same time and the machine is intended to supplant the ordinary method of passing the wire through an oven to bake the enamel upon it.

1,004,771, Oct. 3, 1911. ROLLING-MILL. Charles J. Gibbons of Stratford, Conn. A method of adjusting rolls for cold-rolling met als so that the "spring" of the rolls is compen-



sated for. This is accomplished by wedge-shaped devices operated by a screw and hand-wheel under the roll-neck bearings.

1,004,125, Sept. 26, 1911. COMPOSITION OF MATTER TO BE USED FOR SURFACE COATING WOOD, METAL OR OTHER MATERIAL. Frederick D. Willey of Chicago, Ill. A composition composed of aluminum powder, white-lead, pumice, silica, coach varnish, japan and turpentine. It is used as a heavy enamel or varnish for wood and metal.

Trade Items.

The American Cuckoo Clock Co., of Philadelphia, Pa., manufacturers of clocks, have recently purchased a plant at Germantown and Hunting Park Aves. in that city and will extend their business.

The Berger Mfg. Co., of Canton, Ohio, manufacturers of sheet steel goods, have recently brought a new product in the form of a sheet steel storage bin for holding all kinds of articles. This bin is not only fire-proof but indestructible. These bins are also adjustable so that they can be accomodated to various sizes of goods.

Frank H. Andrews, formerly of the firm of Andrews & Co., of Providence, R. I., has organized the firm of Cornell & Andrews in Boston, Mass., and has opened a plant at 283 Old Colony Ave. The refining of gold and silver and the smelting of sweeps will be carried on. Mr. Andrews was formerly of the firm of Cornell & Andrews of Providence, and who were succeeded by Andrews & Co.

W. W. Wells, 368 Victoria St., Toronto, Canada, is now manufacturing an extensive line of polishing and plating supplies. He is manufacturing buffs at his factory and also has been manufacturing nickel anodes for some time. He is about to instal oil furnaces for melting the nickel and then expects to carry on the manufacture of all kinds of anodes on a larger scale. He is the only manufacturer of nickel anodes in Canada.

The Sumter Telephone Mfg. Co., of Sumter, S. C., manufacturers of telephones, switchboards and telephone appliances, have under consideration the starting of a brass foundry. They now obtain their brass castings from outside parties, and find deliveries slow on account of being quite a distance from the parties who now supply them. They believe that with their own brass foundry they will be able to obviate the difficulties which now follow the delivery of their brass castings.

A suit has been brought against the United States Government by the Raritan Copper Co., of Perth Amboy, N. Y., in which it claimed that platinum and other allied metals have been obtained from gold bullion, submitted by them to the Government for refining, without making any returns upon it. It is claimed that since the installation of the electrolytic refining process at the Mint, the platinum is recovered and that returns should be made upon it. The Government in an unofficial statement, claims that there is no law which requires that returns shall be made upon platinum. The matter seems to be one of law technicality. The Guggenheims (American Smelting & Refining Co.), the United Metal Selling Co., and the Balbach Smelting & Refining Co., of Newark, N. J., are, it is said, also about to commence suit. It is stated that the Government has made a large sum of money by the disposal of the platinum obtained in the gold refining.

The C. W. Kelsey Mfg. Co., of Hartford, Conn., manufacturers of the three wheel motor vehicle called the "Motorette", have gone into bankruptcy. An effort is being made to reorganize the company.

Simons Bro. & Co., of Philadelphia, Pa., the well known manufacturers of sterling- silver novelties, have gone into the hands of a receiver who will continue the business for 30 days. This concern has been in business for many years and manufacture a line of sterling silver goods classed as novelties.

Thomas A. Bond, of Burford, England, brass founder and dealer in metals, would like to make connections with a well known firm in the United States or Canada, from whom he could purchase old metals, such as scrap composition, gun-metal, brass etc. He would like to correspond with those who can supply him.

C. W Leavitt & Co., 30 Church St., New York City, the well known importers of metals, ores and alloys, announce to the trade that they are now handling the "H. H." brand of French antimony, guaranteed to run 99 per cent in antimony. This antimony is manufactured by one of the largest refiners in the world and who control their own mines so that they are in a position to deliver a very high-grade metal at a low price.

The Canadian Jewelers' Company, Ltd., has been incorporated in Montreal, Canada with a capital stock of $5,000,000 to take over the following plants: Hemming Mfg. Co., of Montreal: Hemsley Mfg. Co., of Montreal; William Bramley of Montreal; and J. W. Brown & Co., Ltd., of Toronto. These concerns are among the largest manufacturers of silverware and jewelry in the Dominion of Canada. It is expected that more concerns will be brought into the merger later. The officers of the new company are: J. A. Mackay, president; W. M. Wirt, vice-president; and Oscar P. Jonassohn, secretary and treasurer.

The rapid increase in the use of pyrometers for determining the temperature of metals while being heated, annealed or melted indicates that no metal manufacturer having occasion to heat or melt metals should be without one. The results obtained in the heat treatment of steel has been of the highest importance, and brass manufacturers, silversmiths, manufacturing jewelers and other metal workers have also found the pyrometer of great value. It eliminates all guesswork and renders the operation of heating or melting a certain one. The Brown Instrument Co. 910 Montgomery Ave., Philadelphia, Pa., are the oldest manufacturers of pyrometers in the United States and understand the needs of the metal trades in a marked degree. Their pyrometers are made extremely accurate and one contemplating the use of a pyrometer should fail to correspond with them.

The National Smelting Co., of Cleveland, Ohio, recently incorporated, are now located at 5301 Sweeney Ave., with a fully equipped plant, and are manufacturing aluminum ingot.

The Uniform Seamless Wire Co., of Providence, R. I., have obtained the agency in that district for "Platnide," the new imitation platinum material made by the Platnide Co., of Melrose Highlands, Mass. This alloy is now being extensively used in jewerly as an imitation of platinum.

The portion of the plant of the Holtzer-Cabot Electric Co., at Brookline, Mass., which was recently destroyed by fire, is to be rebuilt. The manufacture of their products of dynamos, motors and electric appliances was, however, not interrupted and manufacturing is continued as usual.

Arthur D. Little, Inc., 93 Broad St., Boston, Mass., engineer and industrial chemist, is to erect a new laboratory at Brookline Ave. and Bellevue St., in that city. One of the features of the building is to be a complete paper making plant for experimental work. This is a new departure in an industrial chemical laboratory. Mr. Little is an authority on the manufacture of paper.

In spite of the increased prices of amy-acetate and fusel-oil the factory of the New Era Lustre Company of New Haven, Conn., the well known lacquer manufacturers, have been obliged to work nights and Sundays to take care of their increasing business. An addition to their factory is also being built which will increase their working area to practically double its present size and give the company the much needed space for manufacturing.

The John C. Culbert Co., of Pawtucket, R. I., scrap metal dealers and brass ingot manufacturers, have gone into the hands of a receiver and application is being made to wind up the affairs of the company. Fred A. Otis, Banigan Building, Providence, R. I., has been appointed receiver. While an inventory and appraisal has not yet been made of the affairs of the company, the receiver states that he believes the company is solvent. The assets will be reduced to cash as rapidly as possible in order to settle the affairs at as early a date as possible.

The Bennett-O'Connell Company of Chicago, Ill., the well known manufacturers of plating and polishing supplies and equipment have moved their factory and general offices to 3600-3604 South Morgan Street in that city, but will maintain their regular city office and warehouse at 15-17 South Clinton Street. This will enable them to maintain rapid deliveries as in the past and their new factory will give them additional facilities for manufacturing. They are now mailing to the trade their new Bulletin No. 108 which describes the new "Excel-All" Electroplating Dynamo which they have recently placed on the market. This Bulletin contains much interesting information and will be sent to those who desire it.

The Spencer Wire Company of Worcester, Mass., manufacturers of wire and wire goods, are to erect a new galvanizing building. This will be 24x80 feet and one story high.

The West Bend Aluminum Co., of West Bend, Wis., was recently incorporated with a capital stock of $30,000 to manufacture aluminum goods and have taken a shop known as the Pick Building. A large variety of aluminum goods will be manufactured.

The patterns and equipment of the National Brass & Iron Co., of Reading, Pa., have been purchased by the Gray Iron Castings Co., of that city and the manufacture of the same line of goods is to be carried on. The National Brass & Iron Co., manufactured a line of art brass and iron goods and recently closed out their business.

The Eclipse Air Brush & Compressor Co., 50 Nelson St., Bloomfield, N. J., have just placed on the market a new device for spraying lacquers, enamels and varnishes. This device is a modification of their regular air brush, but works with a low air pressure which saves much of the lacquer on account of not volatilizing or dissipating the solvent. The air-brush is not expensive. Information will be sent upon request.

W. H. Flavin & Co., 247 Center St., New York City, carry on jobbing nickel plating and polishing for all classes of trade and solicit the opportunity to quote on large or small jobs. They also carry a full line of plating and polishing supplies and will make quotations for all kinds of supplies when desired. This company also manufacture metal novelties for the trade and would be pleased to correspond with anyone desiring to let work of this kind upon contract.

Voland & Sons. of New Rochelle, N. Y., the well known manufacturers of fine balances have recently issued a booklet entitled the "Use and Care of Precision Balances." This booklet will be found of much value to anyone who uses fine balances and will be sent to those who desire it. All fine balance users should obtain a copy. Voland & Sons manufacture fine balances and scales for chemists, silversmiths, platers, manufacturing jewelers and other lines of trade in which precision balances are used.

The Standard Supply Company of New Haven, Conn., are the original makers of "Platers' Cleaning Compound" for cleaning and preparing all kinds of metal work for electroplating. This compound has now been on the market so many years that the name is now almost a "household word." There are few platers who are not familiar with it and the Standard Supply Co., are manufacturing the compound after the same formula as they have for the many years that have passed since its discovery. One of the excellent features of the compound is that it actually cleans the work by solution and not by saponification, and without staining or tarnishing. Information and directions for use will gladly be sent upon application.

A new plant is to be erected by the Western Stove Works at Moberly, Mo. Two new buildings will be erected.

The Standard Silver Plate Co., of Toronto, Canada, manufacturers of silver-plated holloware, are to build a new plant at a cost of $75,000.

The Anthony Company, liquid-fuel engineers, formerly of 45 West 34th. St., New York City, have moved their offices from this location to 9 Jackson Ave., Long Island, N. Y.

The new buildings being erected by the Wrought Iron Range Co., of St. Louis, Mo., are of an extensive nature and will cost nearly $200,000.

The new plant of the Baird Machine Co., at Stratford, Conn., is now practically completed and will shortly be ready for occupancy. The machinery will then be moved from Oakville, Conn., the present location of the plant.

The Electric Smelting & Aluminum Co., of Lockport, N. Y., report that their "Mineral-Cleaner" for preparing and cleaning work for plating or lacquering, is meeting with the most flattering success and users become enthusiastic over it.

Rockhill & Vietor, 114 John St., New York City, manufacturers of the "Nonesuch Plating Machine" have issued a folder describing this machine and giving instructions for using it. This folder will be found useful to all plating barrel users and will be mailed upon request.

The Elm City Gas Stove Co., Court Street, New Haven, Conn., have begun the manufacture of the "Yale" passenger car rack. This is a new and patented rack for use as a baggage rack. The rack can be taken down without removing the brackets so that when it is to be refinished the woodwork of a car is not injured. The rack is made of bronze or brass and lacquered.

A new safety can for preventing the explosion of gasoline or similar liquids, was recently demonstrated in the Berlin Chemical Laboratories, 558 West 171 St., New York City. This can is the invention of a German engineer and can be applied to all cans in which gasoline is stored. The device is a modification of the Davy mine lamp so that a flare-back is impossible. The tests demonstrated the non-explosive character of the cans.

A. A. & H. G. Fogg, 45 Pratt St., Meriden, Conn., are specialists in the making of molds for casting spelter, britannia-metal, antimonial- lead and other soft metals. They are manufacturing metal patterns for the trade and do chasing, modeling, and designing. The manufacture of dies is also carried on. Situated as they are in the very heart of the art metal district of the United States, they are in the best position to cater to the wants of their customers. They would be glad to correspond with those who desire anything in their line, and prices will be quoted when desired.

A job plating plant has been opened by Albert M. Piper at 54 Page St., Providence, R. I.

The Acme Heater Co., Scotten and Michigan Aves., Detroit, Mich., are erecting a new factory for the manufacture of electric stoves.

An addition to the plant of the Popeman Electric Stove Co., of Flint, Mich., is being made. This company was recently organized for the manufacture of electric goods.

The American District Steam Co., of North Tonawanda, N. Y., manufacturers of steam heating apparatus, have recently placed on the market a new radiator valve of a graduated nature so that it is possible to economize on steam in a radiator.

A new factory is to be erected by the Churchill Automatic Electric Clock Company in Pueblo, Cal. A time switch clock is to be manufactured. This clock needs to be wound but once a week. This company was recently incorporated.

A two story brick addition is being erected by the Edmunds & Jones Mfg. Co., 456 Lawton Ave., Detroit, Mich., manufacturers of automobile lamps. Owing to the large increase in their business this company has found it necessary to increase their plant.

The Pierce Arrow Motor Car Co., of Buffalo, N. Y., have purchased a large tract of land in that city, comprising some 35 acres, not far from their present plant, and will erect a large plant for the manufacture of commercial vehicles. Heretofore this company has made nothing but pleasure vehicles.

Owing to differences of the stockholders, the removal of the plant and business of the Imperial Clock Co., of Granite City, Ill., to St. Louis, Mo., has been postponed and a receiver appointed for the company. An injunction against the removal was obtained by some of the stockholders.

The Henry Souther Engineering Company of Hartford, Conn., metallurgists, chemists and consulting engineers, have recently issued a chart, compiled by Henry Souther, giving a table of the Brinell hardness numerals for use in connection with the Brinell machine for testing the hardness of metals. This table has been complied for use with the Cail type of Brinell machine, and which is imported, whenever desired, by this company for their clients. Copies will be mailed upon request.

Those interested in sand-blasting, and there are few metal goods manufacturers who will not find this appliance useful, should send for the catalogue of Leiman Bros., 62 K. John St., New York City. This company have made a special study of the manufacture of sand-blast for the brass, silverware and plating trades, and their machines are designed so that the best results are obtained. The use of the sand-blast for satin-finishing in place of the matt-dip is now becoming extensive and many beautiful effects can be obtained. The catalogue will be sent to those who desire it. This firm also manufacture very efficient blowers and exhaust pumps for all kinds of uses.

A three story brick factory is to be built by the Western Brass Mfg. Co., at 2005 Marshall Boulevard, Chicago, Ill.

The Beaver Mfg. Co., of Birmingham, England, are to start a branch plant in Niagara Falls, Canada for the manufacture of aluminum novelties.

The Pullman Automatic Ventilator Mfg. Co., of York, Pa., has recently placed on the market an improved type of automatic fire-retarding damper which is kept open, under ordinary conditions, by a fusible link.

The officers of the recently incorporated Onondaga Brass Co., of Syracuse, N. Y., are as follows: President and treasurer, H. Mahley; secretary and general manager, L. F. Meagley; vice-president and superintendent, J. Underdown.

It is reported that the Smith & Holtum Mfg. Co., of Clinton, Wis., will move to Janesville, Wis., where they will combine with a Chicago company manufacturing gas and electric fixtures. It is stated that a brass foundry will then be erected.

The Bayonne Casting Co., of Bayonne, N. J., recently turned out a large propeller casting of Monel-metal. This propeller was 16 feet in diameter and with four blades. Its weight was 16,000 lbs. This company make a specialty of Monel-metal castings of large and small sizes.

The name of the Safety Cylinder Valve Co., of Mansfield, Ohio has been changed to the Triumph Valve Co. The capital stock of the company has been increased from $100,000 to $125,000. The business and officers of the company remain the same. The manufacture of packless radiator valves will be carried on as heretofore.

The Niagari Alkali Co., of Niagara Falls, N. Y., manufacturers of electrolytic caustic-potash and muriatic acid, have been allowed a trade mark registration on the name "NIAGALK" which they have been using for some time as the trade-mark for their potash. This trade-mark, they say, will always stand for 90 per-cent caustic potash. They have also issued an interesting pamphlet of their products, which will be found of much interest to all alkali users. Directions for using are given and also soap formulas. This pamphlet will be mailed to those who may desire it.

The New York Buff Co., 87 Center St., New York City, manufacture buffs of every description and for every conceivable class of work. They also manufacture a full line of polishing wheels, felt wheels, emery wheels, and other varieties of wheels used in finishing metals. Their buffing and polishing compositions are now very extensively known and they have made a study of the subject so that they are now able to adapt their goods to the class of work to be buffed and obtain the best possible effect. They are particularly desirous of quoting on buffs as their facilities are such that they can make the most attractive figures. Large or small quantities will glady be quoted upon and very prompt deliveries can be made.

The National Metallic Bed Co., has been incorporated in Everett, Mass., with a capital stock of $20,000 to manufacture metal beds.

The American Brass & Iron Co., of Detroit, Mich., are building a new plant. It is situated at Crystal and Twombley Aves.

The Ventilating Sash Lock Co., has been incorporated in Princeton, W. Va., with a capital stock of $15,000 to manufacture sash-locks.

The Metallic Alloys Co., has been incorporated in Bradford, Pa., to manufacture bearings. W. C. Leary of that city is the treasurer of the company.

The capital stock of the Reading Hardware Co., of Reading, Pa., manufacturers of builders' hardware, locks, etc., has been increased from $900,000 to $1,700,000.

The General Automatic Co., has been incorporated in Syraucse, N. Y., with a capital stock of $250,000 to manufacture cash-registers of the automatic variety.

The Joplin Novelty & Mfg. Co., has been organized in Joplin, Mo., and are to manufacture a line of metal novelties. The goods will be mostly stamped articles.

The H. A. Mathews Mfg. Co., of Seymour, Conn., manufacturers of nickel plated stove trimmings and other metal goods, which was recently destroyed by fire with a loss of $75,000 is rebuilding their plant. New equipment has already been purchased.

The Gilbert & Barker Mfg. Co., of Springfield, Mass., manufacturers of oil furnaces, burners and oil and gasoline appliances, are to erect a new plant in Springfield, Mass. This company is affiliated with the Standard Oil Co.

The New England Collapsible Tube Co., has been organized in New London, Conn., to manufacture collapsible tin tubes for holding toilet preparations, paints, etc. These tubes are made from sheet block tin. L. Tracy Sheffield, W. Kyle Sheffield and Nathan Belcher are the incorporators.

Personal.

William E. Bliss has been elected president of the E. A. Bliss Co., of Meriden, Conn., manufacturers of jewelry and metal novelties, succeeding his father, the late E. A. Bliss.

George H. Turner has been elected vice-president of the Coe Brass Mfg. Co., of Torrington, Conn., succeeding James A. Doughty who has retired on account of ill health, after 25 years service with the company. E. J. Steele has been made secretary and George E. Cole treasurer of the company.

J. Cecil Nuckols, for a number of years advertising manager of the S. Obermayer Co. of Cincinnati, Ohio, has served his connection with the company and has become advertising and sales manager of the Otis Hidden Co., of Louisville, Ky.

Current Metal and Supply Prices.

These Prices are net and are for moderate quantities. Smaller quantities command higher prices. Prices subject to fluctuation.

Acetone, pure, 98-99%	lb.	.22
Acid, Acetic, pure, 30%	lb.	.07
Acid, Arsenious (White Arsenic)	lb.	.20
Acid, Benzoic	lb.	.55
Acid, Boracic (Boric), pure	lb.	.12
Acid, Hydrochloric, see Acid, Muriatic.		
Acid, Hydrofluoric, 30%	lb.	.04
Acid, Hydrofluoric, 50%	lb.	.10
Acid, Muriatic, 20°	lb.	.02
Acid, Muriatic, c. p., 20°	lb.	.07
Acid, Nitric, 38°	lb.	.05⅝
Acid, Nitric, 40°	lb.	.05⅞
Acid, Nitric, 42°	lb.	.06¼
Acid, Nitric, c. p.	lb.	.08
Acid, Sulphuric, 66°	lb.	.01¾
Acid, Sulphuric, c. p.	lb.	.06
Alcohol, Wood	gal.	.50
Alcohol, Denatured	gal.	.55
Alum	lb.	.04
Aluminum, Metallic, in Ingots	lb.	.19½
Ammonium Sulphate	lb.	.07
Aqua-Fortis, see Acid, Nitric.		
Ammonia Water (Aqua-Ammonia), 20°	lb.	.04¾
Ammonia Water (Aqua-Ammonia), 26°	lb.	.06¼
Ammonia Water, c. p.	lb.	.08
Ammonium Carbonate, lump	lb.	.15
Ammonium Chloride (Sal-Ammoniac)	lb.	.12
Ammonium Hydrosulphuret	lb.	.30
Ammonium Sulphate	lb.	.07
Ammonium Suphocyanate	lb.	.50
Amyl Acetate	gal.	3.00
Antimony	lb.	.08
Arsenic, Metallic	lb.	.15
Arsenic, White (Acid Arsenious)	lb.	.20
Argols, White (Cream of Tartar)	lb.	.31
Asphaltum, Commercial	lb.	.05
Asphaltum, Egyptian (Bitumen)	lb.	.30
Benzine	gal.	.15
Benzol, Pure	gal.	.75
Bismuth, Metallic	lb.	2.00
Bitumen, see Asphaltum.		
Blue-Vitriol, see Copper Sulphate.		
Borax, Crystals or Powdered	lb.	.10
Borax Glass	lb.	.35
Cadmium, Metallic	lb.	.75
Carbon Bisulphide	lb.	.10
Calcium Carbonate (Precipitated Chalk)	lb	.10
Chrome-Green	lb.	.50
Copper, Lake, (carload)	lb.	.12½
Copper, Lake (cask)	lb.	.12¾
Copper, Electrolytic, (carload)	lb.	.12½
Copper, Electrolytic, (cask)	lb.	.12½
Copper, Casting, (carload)	lb.	.12⅛
Copper Casting (cask)	lb.	.12⅜
Copper Acetate (Verdigris)	lb.	.35
Copper Carbonate, dry	lb.	.25
Copper Sulphate (Blue-Stone)	lb.	.09
Copperas, see Iron Sulphate.		
Corrosive Sublimate, see Mercury Bichloride.		
Cream-Tartar, see Potassium Bitartarate.		
Cryolite	lb.	.12
Cyanide, see Potassium Cyanide.		
Dextrin	lb.	.15
Emery Flour	lb.	.04
Emery, F F & F F F	lb.	.03
Flint, powdered	lb.	.01
Fluor-Spar	lb.	.01¼
Fusel-Oil	gal.	3.00
Gold Chloride	dwt.	.60
Gum Copal	lb.	.30
Gum Guiacum	lb.	.26
Gum Mastic	lb.	.70
Gum Sandarac	lb.	.35
Gum Shellac, brown	lb.	.50
Gum Shellac, white	lb.	.60
Iron Perchloride	lb.	.25
Iron Sulphate (Copperas)	lb.	.05
Lead Acetate (Sugar of Lead)	lb.	.15
Lead, Pig	lb.	.04½
Lead, Red	lb.	.12
Lead, Yellow Oxide (Litharge)	lb.	.12
Liver of Sulphur, see Potassium Sulphide.		
Manganese, Ferro, 80%	lb.	.10
Manganese, Metallic, pure	lb.	.75
Magnesium, Metallic	lb.	1.50
Mercury Bichloride (Corrosive Sublimate)	lb.	.93
Mercury, Metallic (Quicksilver)	lb.	.46½
Mercury Nitrate	lb.	1.50
Mercury Oxide, yellow	lb.	1.80
Nickel and Ammonium Sulphate (Double Salts)	lb.	.08
Nickel Carbonate, dry	lb.	.60
Nickel Chloride	lb.	.50
Nickel Metallic	lb.	.45
Nickel Sulphate (Single Salts)	lb.	.12
Nitre (Saltpetre), see Potassium Nitrate.		
Oil of Vitriol, see Acid, Sulphuric.		
Paraffine	lb.	.15
Phosphorus, yellow	lb.	.40
Phosphorus, red	lb.	1.10
Pitch	lb.	.05
Plaster of Paris, Dental	bbl.	4.00
Platinum Chloride	oz.	25.00
Platinum Metallic	oz.	46.00
Potash-by-Alcohol, in sticks	lb.	.50
Potash, Caustic (Potassium Hydrate)	lb.	.08
Potassium Bichromate	lb.	.14
Potassium Bitartarate (Cream of Tartar)	lb.	.31
Potassium Carbonate (Pearlash)	lb.	.10
Potassium Chlorate	lb.	.15
Potassium Cyanide	lb.	.25
Potassium Iodide	lb.	2.25
Potassium Nitrate (Nitre or Saltpetre)	lb.	.10
Potassium Permanganate	lb.	.17
Potassium, Red Prussiate	lb.	.60
Potassium, Yellow Prussiate	lb.	.24
Potassium Sulphide (Liver of Sulphur)	lb.	.15
Potassium Sulphuret, see Potassium Sulphide.		
Potassium Sulphocyanate	lb.	.70
Pumice, Ground	lb.	.05
Quartz, Powdered	lb.	.01
Rosin, Yellow	lb.	.04
Sal-Ammoniac, see Ammonium Chloride.		
Sal-Soda, see Sodium Carbonate.		
Silver Chloride, dry	oz.	.75
Silver Cyanide	oz.	1.00
Silver, Fine	oz.	.54⅜
Silver Nitrate, crystals	oz.	.50
Soda-Ash	lb.	.05
Sodium Biborate, see Borax.		
Sodium Bisulphite	lb.	.15
Sodium Carbonate (Sal-Soda), crystals	lb.	.02
Sodium Hydrate (Caustic Soda)	lb.	.05
Sodium Hydrate (Caustic Soda) by Alcohol (in sticks)	lb.	.45
Sodium Hyposulphite ("Hypo")	lb.	.04
Sodium Metallic	lb.	.90
Sodium Nitrate	lb.	.05
Sodium Phosphate	lb.	.09
Sodium Silicate (Water-Glass)	lb.	.04
Soot, Calcined	lb.	.15
Spelter, see Zinc.		
Sugar of Lead, see Lead Acetate.		
Sulphur (Brimstone) in lump	lb.	.05
Tin Chloride	lb.	.43
Tin, Metallic	lb.	.41⅛
Turpentine, Venice	lb.	.35
Verdigris, see Copper Acetate.		
Water, Distilled	gal.	.15
Water-Glass, see Sodium Silicate.		
Wax, Beeswax, yellow	lb.	.45
Wax, Carnauba	lb.	.70
Whiting (Ground Chalk)	lb.	.02
Zinc Carbonate, dry	lb.	.19
Zinc Chloride	lb.	.12
Zinc, Sulphate	lb.	.06
Zinc, (spelter)	lb.	.06½

THE BRASS WORLD AND PLATERS' GUIDE

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Copper vs. Brass Tubing for Use in Automobiles.

The automobile industry is now a very large consumer of small seamless tubing. It is used for conveying gasoline, acetylene gas, compressed air and oil. In order to keep the weight down as much as possible it is made of small diameter so that the tubing itself is not capable of resisting tension or torsion to a degree that a larger size would do. On this account it is very essential that such tubing be made of a material which will resist all the influences that are brought to bear upon it when in use in an automobile.

Some manufacturers use a copper tubing for all work in their cars, while others employ brass on account of its cheapness. Those who use copper either have found that brass is unreliable for this character of work, or have followed the advice of those who have had experience in the matter. Copper is the only reliable material for the purpose and should be employed for all automobile work.

The difficulty with brass is that it is quite apt to crystallize in service. There is no use to which brass is put that is more severe, as far as crystallization is concerned, than that of automobile work. The constant vibration, coupled with the bending of the tubing back and forth, as it actually does to a greater or less extent in service, is sure to cause crystallization sooner or later, and when it occurs the result is usually as disastrous as though some important member of the car had broken. The breakage of the gasoline pipe, it will

readily be appreciated, is as bad as though an axle had broken when the crippling of the car is concerned.

Copper does not crystallize readily and may be called a "safe" material. It will stand vibration, shock and bending that would soon cause brass to crystallize. Whenever possible, too, the copper should be used soft as it will then stand an extreme amount of bending, vibration or torsion without visible effect.

Necessity of Having Brass Goods Dry Before Bright Dipping.

The bright dipping of small brass goods is extensively carried on and by the process it is possible to obtain a very bright and even surface with very little labor. The goods are dipped in bulk in stoneware-baskets, or in wires or racks. The dip used consists of sulphuric acid and nitric acid, with the addition of a small quantity of common salt in some instances. Nitric acid cannot be used alone to a good advantage for the reason that it acts too violently and produces a rough surface. The addition of water renders it even more violent, but by mixing with sulphuric acid the action is so retarded that an even action is produced and one that is comparatively slow.

To do a good job of dipping requires some practice, but the principal error that beginners make is to attempt to dip work that is not completely dry. A few drops of water on the surface of a brass article would naturally appear to have no influence on the dipping, but it actually does and is the means of causing an uneven and spotted surface. If manufacturers would be careful on this point, they would have far less difficulty with their dips. Not only does the constant introduction of wet brass articles into the dip cause an uneven surface on them when dipped, but the dip itself is constantly diluted so that, after a time, it will begin to act too violently and a rough surface will be produced. While a little water in a dip can be tolerated, when the acids are quite strong, any considerable quantity causes the nitric acid to act with great rapidity and a good surface on the brass cannot be obtained.

The reason that drops of water on the surface of the brass goods cause an uneven surface is that, when they are introduced into the dip, the water, coming in contact with the acid at that particular spot, dilutes it and also heats it so that not only is the action far more rapid but a different action takes place. The result, of course, is that the surface of the brass where the water exists is of a different character than the portions that were dry and were acted upon in this condition. The dipped surface of the brass, therefore, when completed is streaked and mottled.

Much of the small work that is bright dipped can be dried by running through hot water and then swinging until dry. It will then be free from any drops of water on the surface. Other kinds of work may require special drying, but it can be easily carried out, whatever may be necessary.

Those who have had difficulty in obtaining a smooth, even surface on brass and one that is uniformly bright, should investigate the water matter as in many instances it has been found that a smooth working dip has been impossible on account of this adherence of water, and it was imagined that the dip itself was the cause.

The Government to Attack the Aluminum Trust.

Much interest is being displayed in the metal trade by the announcement that the Government is to file a suit against the so-called "Aluminum Trust" or, as it is called in the trade, The Aluminum Company of America. The claim of the Government is that it is a combination in restraint of trade, a monopoly and a violation of the Sherman act. The company is charged with having absorbed the Pittsburgh Reduction Co., the original aluminum producer in the United States, and the making of agreements to control prices and the product of the business. Under the charge of agreeing to fix prices, it is alleged that the corporation entered into an agreement with several manufacturers of aluminum wares to control prices throughout the world. This agreement, it is claimed, was drawn up in Paris.

All vanadium now used in the United States is obtained from practically one source, that of Peru, South America. Extensive deposits of vanadium ore are located there and are controlled by American interests.

The Effect of Phosphorus on Composition and the Appearance of the Ingot Metal Surface Containing It.

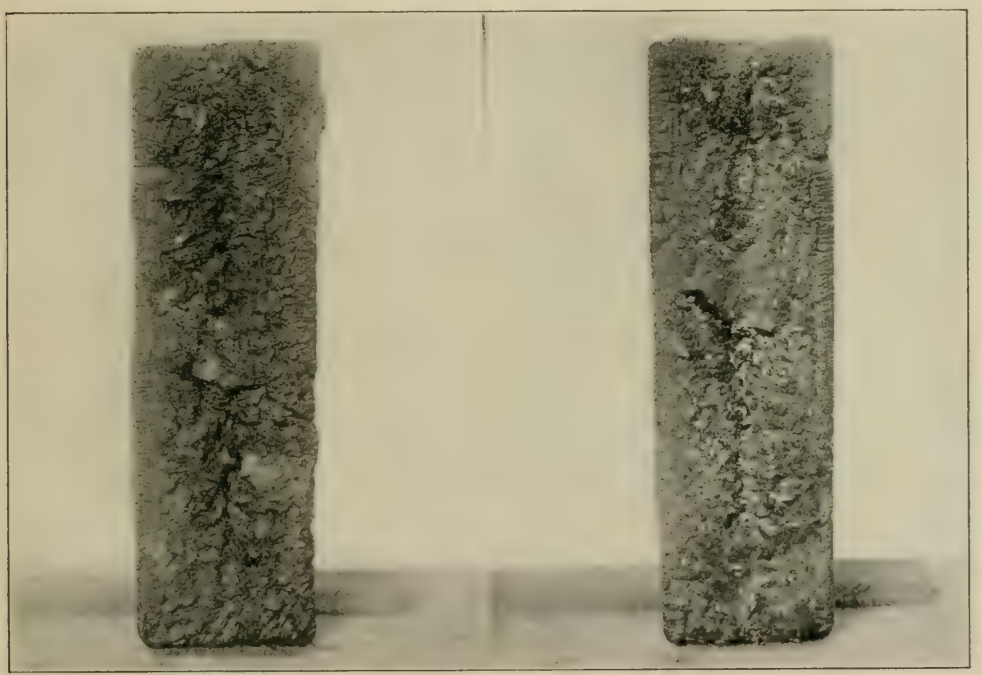
The use of phosphorus in the tin-bronzes such as composition, steam-metal and similar commercial alloys is now quite extensive, and when intelligently employed it has a beneficial effect. When too much is employed, however, the effect is opposite and harm follows for the majority of work for which the metal would be used.

There seems to be an erroneous idea in regard to the effect of phosphorus on bronzes and many founders seem to believe that it is a difficult matter to ascertain when phosphorus is present except by chemical analysis, but this is not the case and the appearance of the ingot top will indicate whether it is present to a degree that will be injurious.

In the photographic reproduction, are shown two ingots of composition of approximately the following mixture:

Copper	85%
Tin	5%
Lead	5%
Zinc	5%

In the metal free from phosphorus, the surface of the ingot is quite rough and there are no signs of smoothness. Those familiar with ingot composition will readily recognize the appearance. The color is black or brownish-black if there is but little lead present. In the other ingot, 0.05% of phosphorus was introduced by means of phosphor-tin, but otherwise the composition of the metal was the same. It will be noticed that the surface of the ingot is different from the other in that it has smooth portions and the whole surface is not as rough as in the case of the metal without phosphorus. The effect of the phosphorus, then, is to render the surface of the ingot more or less smooth, and if a large excess is present the whole surface will be smooth and free from any roughness whatever. When phosphorus is present in a small amount the appearance of the ingot top is "patchy", i. e. parts are smooth and parts are rough. This characteristic surface may be understood by an examination of the ingot in



No Phosphorus. Phosphorus.

Ingots of Composition With and Without Phosphorus, Showing Effect of Phosphorus on the Surface of the Ingot.

the illustration containing the 0.05% of phosphorus.

As far as the effect of phosphorus on the casting qualities of the tin bronzes (such as composition, steam-metal, etc.) is concerned, it may be said that it is quite different when the mixture contains zinc, from what it is in the straight copper and tin alloys.

The so-called "phosphor-bronzes" proper consist of copper and tin, or copper, tin and lead. Zinc is not used in them. To such mixtures may be added a large quantity of phosphorus, even up to 1%, and still have a good casting. When zinc is used in the mixture, as it always is in composition, steam-metal or other smilar commercial alloys, the effect of the phosphorus is quite different. In order to obtain any benefit from it, extremely small quantities must be employed and amounts that are used in ordinary phosphor-bronze, say from 0.20 to 0.50 per cent, will utterly ruin the metal. It has been found by experience that to obtain any good effect from phosphorus in composition, steam-metal or similar mixtures containing copper, tin, lead and zinc, not over a few hundredths of a per-cent should be present. Ordinarily, from 0.01 to 0.02 per-cent of phosphorus can be introduced without incurring danger of injuring the metal.

The first noticeable effect of phosphorus on bronzes is to produce a clear surface on the surface of the molten metal, by the reduction of the oxides that form upon exposure to the air. This takes place either when zinc is present or absent in the bronze and the effect of the excess is not noticeable in the melted metal. In order to find its effect, however, the casting made from the metal should be examined. A sand casting is the kind in which the excess of phosphorus is so noticeable.

The injurious effect of an excess of phosphorus on the tin bronzes containing zinc (composition, steam-metal etc) is that it produces pin-holes in the casting. It seems almost paradoxical that, inasmuch as the object of phosphorus in the bronzes is to reduce the oxide and eliminate the blowholes (pin-holes are small blowholes), an excess will cause them. It appears analagous to a medicine like strychnine which, in small amounts is beneficial, but in larger doses acts as a strong poison. So it is with phosphorus, a large amount acts as a "poison" and a small quantity as a "medicine."

The effect of phosphorus on composition, steam-metal or other bronzes containing copper, tin, lead and zinc, may be summed up as follows:

1. In the ingot metal it produces a "patchy" surface on the top with alternate or varying smooth and rough portions, if the quantity present be only a few hundredths of a per-cent.

2. If more than a few hundredths of a per-cent of phosphorus is present the ingot surface will be more or less smooth depending upon the quantity. With a considerable amount the entire surface will be smooth.

3. When a few hundredths of a per-cent of phosphorus is present in the metal, the castings do not show pin-holes, but on the other hand the oxide in the metal is reduced and the tendency for blow-holes to form is greatly reduced.

4. When an excess of phosphorus is employed, blow-holes are sure to form, depending on the quantity used. The more the phos phorus, the greater the tendency.

In conclusion it may be said that the common error in the use of phosphorus is to add too much. In the case of the mixtures containing zinc, the amount should not be over 0.01 or 0.02 per-cent and it will be found that benefit is derived from it.

Use of Manganese in Aluminum-Bronze.

In a patent recently issued to Pierre H. G. Durville of Paris, France, the use of manganese in the aluminum-bronzes is claimed. The patentee states that, while manganese does not have the property of reducing oxide of aluminum and freeing the aluminum-bronze from it, it does have the advantage of removing other injurious elements and compounds. Among these are sulphur. On this account, the introduction of manganese in aluminum-bronze, it is said, is a distinct advantage.

The amount of manganese employed may be from 0.05 to 5.00 per cent and the following limits are claimed:

Copper	86 to 95%
Aluminum	6 to 11%
Manganese	0.05 to 5%

The introduction of the manganese does not affect the casting or rolling qualities of the metal, and it is stated, that the bronze containing it is much sounder and closer grain, and at the same time stronger than aluminum-bronze without it.

Improvements in the Electroplating of Plaster of Paris.

Those who have attempted to electroplate plaster of Paris have found that the principal difficulty lies in rendering the plaster impervious to water. Unless this is done, when it is placed in the plating solution, the solution itself will soak in and cause the air in the pores of the plaster to ooze out in the form of small bubbles which will prevent the electrodeposited metal from adhering. In order to successfully electroplate the plaster, it is absolutely necessary to render it impervious to water or, in other words,, to make it perfectly water proof.

The coating of the plaster with shellac or other varnishes is satisfactory theoretically, but when it comes to actually doing it in practice, there are some obstacles in the way. The difficulty is in completely and thoroughly coating the surface. Even the slightest pin prick or hole will allow the solution to permeate and thus spoil the whole operation. In order to render the electroplating positive, therefore, it is necessary to use some other method than varnishing and this feature constitutes the improvement.

It has been found that the only satisfactory way is to soak the plaster in some waterproof material, such as a wax or resin, so that the pores will be penetrated and the whole made so that no water can enter. In order to do this, however, care must be used in selecting the wax or resin. Ordinary paraffine is good, but it leaves the surface too smooth for the copper powder or graphite to adhere. Beeswax is good but is also rather smooth. Ordinary rosin is good as far as the surface is concerned but it has too high a melting point. The best material that has been found up to this time is the following composition:

Beeswax	1 lb.
Rosin	1 lb.

The beexwax and rosin are melted together and are ready for use.

In order to saturate the plaster with this composition it must be *dry*. When first cast, an article of plaster of Paris contains a large amount of water. This should be expelled by heating for some time at a rather low heat. A temperature of about 220 degrees F. or slightly above that of boiling water is good until the greater part of the water has been expelled. The use of a higher temperature at first usually results in drying the plaster so rapidly that it may crack. After it appears dry, increase the temperature to about 300 degrees F. in order to expel all the water and leave the plaster bone-dry.

When thus dried, the plaster is immersed in the mixture of beeswax and rosin, which is kept just barely melted (no higher). If allowed to rise too high, the plaster is apt to crack. The melting point of this composition is about 250 degrees F. and it should be maintained at this temperature. When the plaster is first immersed in the molten mixture of the rosin and beeswax, fine air bubbles begin to come off. This is the air being expelled from the pores of the plaster. After

Fig. 1. The Plaster Before Plating.

five or ten minutes, the bubbles will cease showing that the plaster has been saturated with the composition. It is then removed and allowed to cool. It will then be found that the plaster has become heavier and is saturated with the composition so that it is waterproof. The surface, too, will be smooth, as the composition soaks in.

The next operation is to varnish the surface of the plaster with ordinary cheap, furniture varnish. Any kind will do. The varnish should be thin enough to spread evenly, and if not add a little turpentine to it. Then give an even coat to the plaster article.

Allow the varnish on the plaster article to *nearly* dry so that it becomes "tacky" or sticky. Then apply copper powder to the surface by means of a soft, camel's hair brush. The whole surface is carefully brushed over and be sure enough is put on to cover the whole surface. Do not dust off, but leave the excess on. Now leave for about 24 hours until the varnish dries hard. A quick drying furniture varnish is preferable on this account. When dry, dust off the excess of the copper powder with a soft brush and the plaster is ready for plating.

Fig. 2. Plaster Article After Plating.

The copper powder is known as "copper-bronze" powder in the trade and is copper powdered to an impalpable condition so that no grains can be felt. It can be obtained in the market from dealers in bronze powders. It should be as fine as possible or it will not answer the purpose. When good it is as fine as electroplaters' graphite.

The plaster article thus covered with the copper powder is immersed in the following solution:

Water	1 gallon
Nitrate of Silver	5 oz.
Potassium Cyanide	5 oz.

If the cyanide does not dissolve all of the nitrate of silver (on account of free acid in it), add a little more. The object is to have a solution with no free cyanide.

The plaster, when immersed in the solution will immediately become covered with a coating of silver on account of the precipitation of the silver by the copper. This operation renders it easy to deposit the copper subsequently plated on.

The article is now plated in an acid copper solution in the usual manner. The acid copper solution is made as follows:

Water	1 gallon
Sulphate of Copper	2 lbs.
Sulphuric Acid	1 oz.

The article should have plenty of anode surface around it in order to obtain a uniform deposit. The current should be weak so that the deposit will be smooth and free from burning on the edges. From 1 to 1½ volts are suitable for this purpose. A copper deposit of suitable thickness will take several hours on acount of the low rate of deposition, but if forced, it will be rough and burned on the edges.

The success of the operation depends upon two things:

1. The complete drying of the plaster.
2. Avoiding overheating the beeswax and rosin mixture in order to prevent the cracking of the plaster.

Strength of Soldered Joints of Monel-Metal and Copper.

The relative strengths of soldered joints of Monel-metal and copper were recently made and indicate that a soldered joint of Monel-metal is stronger than that of copper. The following were the test results;

Sheet 0.021 in. Thick.

Copper	Monel-Metal
1910 lbs.	2905 lbs.
1900 lbs.	2605 lbs.
1970 lbs.	2400 lbs.

Sheet 0.125 in. Thick.

Copper	Monel-Metal
6400 lbs.	7200 lbs
6170 lbs.	6085 lbs.
6340 lbs.	7420 lbs.

The sheets were all 2 inches wide and with a lap of ½ inch for soldering.

Properties of Metallic Cerium and Its Alloys.

Cerium is a member of a group of rare metals known as the "cerium group" and which have already found extensive use in the arts. The metals themselves have not been used, but the oxides are employed in the preparation of the well known Welsbach gas light mantles. Cerium alloys are also used in self-igniting match boxes, etc. The extensive use of these oxides, known as the "rare-earths", led Alcan Hirsch to carry on some very extensive experiments both in the preparation of metallic cerium and its alloys. The physical and the chemical properties were all carefully investigated. The results of these experiments were given in a paper read before the *American Electrochemical* Society at the Toronto Meeting, Sept. 21-23, 1911. The results of these experiments are as follows:

The method used for the preparation of metallic cerium, and which the author found to be the most satisfactory of any tried, was by the electrolysis of the anhydrous chloride of cerium in an iron vessel. A graphite anode was used. A small amount of sodium and potassium chlorides was first fused and then the cerous chloride added. More of the sodium and potassium chlorides was added as the electrolysis went on. At the end of two hours, with a current of 110 emperes, 40 grams of a fairly well fused metal was obtained. This first experiment indicated the feasibility of the process and it was afterwards used on a larger scale.

The metallic cerium thus obtained was not quite pure but contained about 1 per-cent of iron, with small amounts of cerium oxide and carbide. The purification of the cerium was affected by amalgamating it with mercury (it readily forms an amalgam) and the distilling in an iron pipe with a long portion at the top for cooling the mercury vapor. The iron and other impurities float to the top and can be removed. The cerium amalgam, thus freed from foreign substances, is strongly heated in a magnesia crucible to drive out all of the mercury and pure cerium results. A very high temperature is required for this purpose, and the heating is carried on in a magnesia crucible placed in a quartz vessel, in a vacuum in order to remove the last traces of mercury. The cerium thus obtained is quite pure. Unless the magnesia crucible is used, the high temperature required will soften the quartz. The cerium thus obtained has the following properties:

Properties of Metallic Cerium.

According to the author, metallic cerium is a white metal resembling steel in color. It is highly malleable and ductile and may readily be rolled into sheet or drawn into wire. A strip of the metal was rolled down to thin sheet 0.015 in. in thickness. It is quite soft and seems to resemble tin in this respect. The author states that it is not quite as soft as lead. It is easily cut with a knife.

The melting point was determined by the author and found to be 635° C. (1175° F.) or practically that of aluminum (very low red heat). When melted, cerium oxidizes rapidly in the air so as to render the casting difficult. In order to cast it successfully it must be poured in an inert atmosphere, such as that of hydrogen or carbon dioxide. When this precaution is taken, the metal may be readily cast in regular molds.

The specific gravity of cerium was found to be 6.92 or about the same as zinc. The atomic weight, as determined from pure salts is given by the author as 140.25.

While the author made no direct determinations of the heat conductivity of cerium, it appeared to be fairly high, he says, and if so is an example of a metal which has a high heat conductivity and low electrical conductivity.

The electrical conductivity was measured on a cast rod and the specific resistance is given at 71.6 microhms per cubic centimeter.

The hardness of the cerium was measured by means of the scleroscope and found to be 9.5 (hard steel is taken as 100).

The tensile strength of a cast cerium rod was found to be 12,900 lbs. per sq. in. This is quite low and approximates that of pure tin.

When cerium is filed, the filings will ignite unless care is taken and this property has been made use of in the preparation of the so-called "pyrophoric alloys" which are usually composed of about 70 per-cent of cerium and 30 per-cent of iron.

Pure cerium is very slightly attacked by cold water, but when boiling it is more strongly attacked and hydrogen gas is slowly given off. At the same time the surface of the metal is blackened. Concentrated sodium hydroxide solution, concentrated sulphuric acid alcohol or ammonia have no action on the metal. Dilute sulphuric, nitric and hydrochloric acids

attack the metal vigorously. Salts, such as ammonium or sodium chloride, have moderate action on it.

When heated in the air to 160° C, if in a comparatively finely divided condition, cerium burns with luminescence.

Alloys of Cerium.

A number of alloys were studied and were in most cases high in cerium, usually containing about 70 per-cent of this metal. The method of making the alloys was first to melt the cerium in a porcelain crucible under a layer of common salt and then add the other metal in small pieces.

Silver alloys with cerium and the metal is hard and brittle. It has a silvery white lustre.

The alloy of gold and cerium is soft and has a reddish color. Upon standing in the air it disintegrated to a purplish-black powder.

Cerium and platinum alloy to a hard, white metal that is pyrophoric. It disintegrated slightly upon standing in the air.

With copper, cerium alloys to a hard and brittle metal which disintegrated to a powder upon standing.

Tin and cerium form a pyrophoric alloy which standing a few months disintegrated to a powder.

Cerium and antimony alloy to a soft metal which seems to be permanent in the air.

With arsenic a fairly soft alloy was produced which was apparently permanent in the air.

Carbon combines with cerium and hardens it. This carbide is produced in reducing the cerium in presence of it.

Silicon and cerium combine with the formation of a hard and brittle silicide. When about 15 per-cent of silicon is used a good pyrophoric alloy is formed.

Tellurium unites with cerium forming a brown, pulverent mass. The tellurium and cerium combine vigorously.

Upon adding selenium to molten cerium, two products were formed. One was a powder and the other a metallic alloy which was apparently cerium selenide dissolved in molten cerium.

Lead and cerium combine with a violent action. The alloy is very soft and emits sparks of a reddish color when filed. The alloy disintegrates slightly upon standing in the air.

Cerium and calcium unite quietly with the formation of a white alloy, harder than either of the constituents. It emits sparks when filed and is apparently permanent in the air.

Sodium and cerium alloy quietly with the formation of a hard alloy that is slightly pyrophoric and oxidizes upon exposure to the air.

Aluminum alloys with cerium readily and the alloy is hard and brittle. It disintegrates without oxidation and is not pyrophoric.

When zinc and cerium alloy, there is a violent action, almost explosive. The alloy is hard and brittle. It is pyrophoric and remains unaltered in the air.

Cadmium combines with cerium with the same vigor as zinc. The alloy is hard, brittle and pyrophoric. It oxidizes upon exposure to the air but does not disintegrate.

The chromium and cerium alloys are white in color and hard and brittle, unaltered in the air and somewhat pyrophoric.

Manganese combines with cerium forming a hard and pyrophoric alloy permant upon standing.

The nickel and cerium alloys are somewhat softer than those of cerium and iron. The ones high in cerium were very pyrophoric.

The iron and cerium alloys are very interesting as they were the first pyrophoric alloys known and were discovered by Dr. Auer von Welsbach. The alloys containing about 70 per-cent of cerium are hard and somewhat brittle. This is the alloy now used so extensively in self-igniting match-boxes and gas igniters. When filed, sparks are emitted which have the property of igniting easily inflammable substances such as gasoline or illuminating gas.

With tungsten a hard and brittle alloy was obtained that was pyrophoric.

Cerium forms amalgams with mercury readily and with a few per-cent they are brittle, but when a greater amount of cerium is used, they are solid. They oxidize easily in the air and those containing 8 or 10 per-cent of cerium take fire in the air.

With magnesium highly pyrophoric alloys are formed. The alloy containing about 83 per- cent of cerium is highly pyrophoric. Most of these alloys are brittle and are readily pulverized. Excellent flash l'ght powders can be produced from the ones high in cerium.

For the manufacture of rubber molds, metals which are not acted upon by sulphur must be used. The copper or lead alloys, on this account are not serviceable. Aluminum, iron or the tin alloys, such as genuine babbitt-metal, are good for the purpose.

Blowholes in Composition and Bronze Castings and their Cause and Prevention.

The two principal difficulties encountered in making composition or bronze castings are:

1. Dross or dirt in the castings.
2. Blowholes or pinholes in the metal.

Dross in the castings is usually a case of bad gating or pouring, or defect in molding. Blowholes or pinholes are always the result of bad melting.

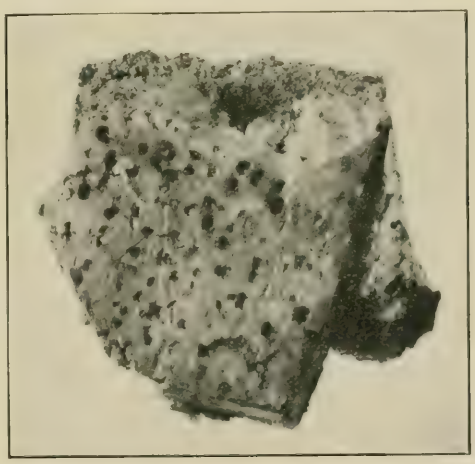
Let it be understood that blowholes, however large, and pinholes, however small, are the same. Pinholes are simply blowholes and the cause is the same as that of larger ones. It is a mistaken idea that blowholes are caused by wet sand or rapid pouring. It will never be found that they are the cause.

Blowholes are formed in the casting by gas. During the melting of the composition or bronze, this gas is absorbed, and while the metal is cooling in the mold, it is expelled with the formation of the blowholes. If a small quantity of gas is absorbed, then small blowholes (pinholes) result. If a large quantity is absorbed during the melting, then a large quantity is given out in the cooling of the molten metal in the casting with the result that large blowholes are produced. Such is the theory and facts of the cause of blowholes in sand casting, but there are other agencies which enter the problem and render the gas absorption great or small.

Some foundrymen say that scrap metals do not cause them the trouble with blowholes that they experience with new metals, and this may be true if the melting is carried on imperfectly. The reason for this is the fact that pure copper, when melted, absorbs gases far more readily than the composition or bronze after made. This will be subsequently explained.

The ideal method of melting metals is in a vacuum, and this is now carried on in the manufacture of electric lamp filaments of tungsten and tantalum. All gases in the metal before melting are then extracted and there is no opportunity for more to enter; but this method can be applied only to melting very small quantities of metals. The next best method is to melt the metal without fuel, as in the electric resistance or induction furnace. There are, then, no gases present and air is the only one in contact with the metal. Oxidation takes place, of course, and on this account the process is inferior to vacuum melting. In the other melting process, or the so-called "regular" one, the metal is melted with a carbonaceous fuel of some kind and this fuel, when burned, forms products of combustion that are the cause of the blowholes. There is rarely complete combustion in a melting furnace and on this account a variety of gaseous products are formed. These may be carbon monoxide, hydrogen gas, and various gaseous hydrocarbons. Large quantities of carbon dioxide gas, of course, are formed. In addition to these gases there is always more or less sulphurous products.

In melting metals in an open flame furnace, such as a reverberatory furnace, the surface of the metal exposed to the products of combustion is so great that there is a much larger gas absorption than in the case of melting in crucibles, where the surface exposed is much smaller. This fact is why crucible melting always gives the best and soundest castings.



Piece of a Composition Casting Cast in Sand and Showing Blowholes.

Every foundryman knows that if metal is melted in direct contact with the flame or fire, the resulting metal is not as good as though a covering of some kind is used to protect the surface. Either a flux or charcoal is used and this serves to protect the surface of the molten metal while the melting is going on and prevent the absorption of gases.

It is a singular fact that pure metals absorb gases much more rapidly and vigorously than alloys. Some metals do not absorb gases very

readily, while others are apparently eager to take them up. Low melting metals, such as tin, lead or zinc, do not have the property in any marked degree, while metals which melt at a higher temperature, like copper or silver, absorb them rapidly. Copper, perhaps, is the metal which has the property in the most marked degree and seems to absorb gas more eagerly than any other, even surpassing silver in this respect. It is for this reason that copper alloys are so apt to contain blowholes and that pure copper castings are so difficult to cast sound and solid.

In melting copper by the ordinary means, that is with the usual coal, coke, oil or gas furnace, the amount of gas absorbed depends upon three things: First, the temperature of the metal. Second, the character of the covering. Third, the length of time in the fire after melting. If copper is heated far above its melting point, the amount of gas absorbed is much greater than if not allowed to rise higher than the actual melting. In other words, the hotter the copper the more gas will be absorbed. The character of the covering on the molten metal also has a direct influence upon the amount of gas absorbed during the melting. The worst possible condition, of course, is to melt the metal without any covering at all as there is then every chance for gas to become absorbed. Many of the worst cases of blowholes and oxidized metal are caused by this one thing. The covering, in the case of copper should be charcoal or its equivalent. A flux of some kind can be used, but on new metals it does not give as good results as charcoal. Charcoal is now universally used and has these advantages: First, it is a strong reducing agent and tends to reduce any oxide of copper that may form. Second, it contains no sulphur. Third, it covers the metal mechanically and prevents access of the products of combustion. It is a noteworthy fact that in brass rolling mills, where the finest quality of brass is made and new metals used entirely, charcoal, and plenty of it, is employed in melting. If melters would bear this in mind, and keep their copper well covered as soon as melting begins, then there would be far less difficulty experienced with blowholes.

Coal or coke will not answer as a covering for molten metals for the reason that they contain sulphur which produces blowholes and dirty metal. There is nothing so good as charcoal, and it should be rather fine (about the size of coarse gravel) in order to obtain the best results. When too coarse, it does not protect the metal sufficiently, and when too fine, it is apt to blow off.

The length of time the copper is allowed to remain in the fire after melting has a very important bearing upon the amount of gas absorption and its production of blowholes. The longer it is left the more gas will be absorbed. For this reason, the sooner metal is poured after it has melted and arrived at the right heat the better the casting. Leaving metal in the fire too long after melting is a very common error and is responsible for many cases of blowholes. Not only does the metal then have more opportunity for absorbing gases, but the temperature usually rises so that they are more vigorously absorbed. It should always be the rule to pour metal as soon as it is melted.

Molders are responsible for this condition as they may not have their "heat" ready for pouring when the metal is melted and, therefore, it is allowed to remain in the fire until ready. This results in the metal remaining melted too long and, possibly becoming too hot.

As previously mentioned, pure metals absorb gases more readily than alloys, and for this reason, in making new composition or bronze from new copper, greater care is required than in melting metal already mixed. However, alloys absorb gases readily and what has been said about melting copper applies equally as well to copper alloys such as, bronze, brass or composition.

To assist the brass founder in melting, the following rules may be adopted for the production of the best quality of metal and sand castings. They will apply equally as well to the melting of the brasses and bronzes as to pure copper.

Instructions in Melting

1. Melt in such a way and with such a heat that *all* the metal becomes liquid at about the same time. This avoids overheating or "burning" one portion of the metal before the rest has begun to melt. A moderate heat is preferable to a high one, even though the melting is a trifle prolonged, as it avoids overheating the exposed portions of the metal.

2. Do not allow portions of the metal, such as ingots or gates to project above the top of

the crucible. When this is done, such portions are overheated and "burned" before the bottom portions begin to melt. It is better to use less metal in the crucible at the beginning so as to avoid this and have all portions covered with charcoal.

3. Warm the metal up before feeding into the crucible, after that in it has melted, so that it will melt more readily when introduced into the crucible. The metal may be warmed on top of the furnace and as long as melting does not take place there is no gas absorption.

4. Put some charcoal into the crucible as soon as the metal begins to melt and add more from time to time, if necessary so as to keep the surface of the metal free from exposure. If a portion of the molten metal is exposed, then harm will result. A covering of charcoal to a depth of about an inch is usually necessary.

5. As soon as copper (if new metals are used) is melted and has arrived at the right heat, add the zinc, tin, lead or other metals to be used. Far more harm results in allowing copper to remain melted for any length of time than mixed metals, as it absorbs gases so readily. This is why it is necessary to add the alloying metals to the copper so soon. It may be said, in this connection, that this feature is one frequently overlooked by melters and is responsible for much bad metal.

6. Stir thoroughly after adding the alloying metals and allow the heat of the metal to rise to the required pouring temperature. A good, thorough stirring is required for the perfect mixing of the metals.

7. When the right heat has been obtained on the metal, pour it into the molds and do not allow it to remain in the fire any longer than is necessary. Good castings depend upon this point.

8. Do not allow the heat of the metal to rise far above the pouring temperature and then cool down with gates or scrap. Metal that has once been overheated is injured and cooling with gates or scrap, while reducing the temperature, will not overcome the injury done in overheating. Metal that has not been allowed to rise above the required temperature is always better than that which has been overheated and cooled down with gates.

9. In conclusion, do not allow molders to keep their melted metal in the fire while their heat is being put up. The molds should be ready at the same time as the metal or before. Better metal will result if the molders have to wait for it.

Electrolytic Nickel Smelting in Norway.

Norway possesses extensive deposits of nickel ores, much of it containing as high as 2 per cent of the metal. In former years nickel mining was of some importance, but competition with the richer ores of Canada and the United States could not be maintained, and most of the mines ceased operation. During the closing decade of the last century the annual production of nickel sank to 7 tons. Since 1900 the industry has revived, and there is an annual output now of 70 tons, nearly all of which is used in the Kingdom. In 1909 the only mine worked, that of Eije, yielded 5,770 tons of ore containing 1.1 per cent of nickel. In the smelting works 2.77 tons matte are obtained from 100 tons of ore. This matte contains 40 per cent of nickel and 25 per cent of copper. It is refined in the new electrolytic works at Christianssand, which are equipped for an annual production of 400 tons of the metal. The production of electrolytic nickel is a much more complicated operation than are those yielding aluminum or sodium. The copper-nickel matte is used as anode in a weak acid bath. Both metals are dissolved and pure copper is deposited on the cathode. At a certain point, when the electrolyte contains in solution a relatively large percentage of nickel, the current is interrupted. The remaining copper is first removed from the solution (by hydrogen sulphide) and then the iron is removed with the customary precipitants. From this purified and heated solution nickel is deposited electrolytically, insoluble anodes being used. The electrolytic nickel has a high degree of purity and is fairly compact. The total consumption of electricity is relatively large and the process can be employed with advantage only where the cost of the current is exceptionally low, as is the case in Norway.—*Daily Consular Report.*

Tin exposed to very low temperatures crystallizes and breaks. Lead is also subject to this difficulty although not in as marked a degree.

Correspondence.

American Vanadium Company Owner of the Peruvian Vanadium Ore Deposits.

Editor:

In your November issue of *The Brass World* I note a long article regarding the new plant of the Vanadium Metals Company at Groton, Conn., for which please accept our thanks. The description and photographs of the plant are very good, but, in justice to the American Vanadium Company of Pittsburgh, would call your attention to the error regarding vanadium ores and vanadium alloys.

The American Vanadium Co., is the owner of the Peruvian Vanadium ore deposits, and is the manufacturer of vanadium alloys, and is responsible for the marvelous progress made by steel manufacturers in the use of vanadium steel.

The Vanadium Metals Co., has no vanadium ore deposits, manufactures no vanadium alloys and is interested only in the manufacture of high grade composition metals. Both companies are controlled by the same individual interests but are operated separately and are different corporations. Would also state that George L. Norris is the engineer of tests of the American Vanadium Co.

I hope you will make this correction in your December issue and thanking you for your courtesy, I remain

Yours very truly,

J. Rogers Flannery

President,*

Vanadium Metals Co.

The good results obtained in the use of Lake Superior copper are supposed to be caused by the presence of a small amount of arsenic which acts as a deoxidizing element in the making of brass.

Ordinary brass pins are not nickel plated as frequently supposed, but are tinned by means of a hot solution of cream of tartar. The pins are placed in the solution in contact with sheets or plates of block tin and heated for about 10 to 12 hours. The tin then deposits upon the brass in a very white coating.

*Also General Manager, The Vanadium Metals Co.

The Effect of a Low Temperature Upon Tin and Lead.

The well-known tendency of good tin to lose its lustre and finally to crumble into a fine grey powder when kept in cold places suggests to *The Lancet* the possibility of this failing having led to the use of the word "tin" as a term of reproach, as in such expressions as "a tin-pot institution" or "a tin soldier." Our contemporary also comments upon the curious analogy between sicknesses in certain metallic elements and disease. The susceptibility of tin to "cold" was pointed out in *The Ironmonger* of June 24 (p. 56), when it was shown that if tin is to be protected effectually against the ravages of cold, it should be kept above 18° C. Where the temperature is below this figure, the metal rots, and is even infectious, for decaying tin in contact with healthy lustrous tin soon spoils it and reduces it to its own unhealthy state. A curious example of this is an old tin vessel in the British Museum, which has been affected by the low temperature of the room and has gradually changed into grey tin. The transformation was first noticeable on the surface of the metal, which became coated with thin grey powder, and this accelerated the velocity in the change of the good tin underneath. The question of alloying the tin with lead, such as *The Lancet* suggests as a remedy, has not been sufficiently investigated, but the literature of the subject points to the opinion that lead is affected by temperature and it is significant that in Canada, where a particular kind of roofing has been introduced, composed of glass in an iron frame with lead supports, architects have specified against the use of lead. In certain cases the "illness" of metallic elements has been a drawback to the use of metals in industrial and domestic applications, but fortunately the disease usually yields to treatment, based upon the diagnosis of the metallurgical chemist.—*The Ironmonger.*

Solder which has been exposed to damp air for some time and become more or less oxidized on the surface is not as good as fresh metal. It does not run freely and leaves a film behind it. The oxide on the surface is the cause of this difficulty.

The "Rojas" Process of Coloring Metals (Electrochroma).

One of the most interesting processes that has appeared in the scientific world for long time is that invented by F. A. Rojas of the Rojas Electro-Chemical Co., 516 West 25th. St., New York City. This process has been named "Electrochroma" by him, the word chroma being derived from the Greek and meaning color.

By means of this process, deposits or smuts may be plated upon the surface of any metal, without previously plating it with any other metal, as must be done in other coloring processes. The deposit is produced upon the cathode in the usual manner, but instead of being metal, is of the desired color. Any desired shade may be produced, green, red blue, brown, gold color, etc., etc. One of the most valuable features of the process is the fact that it can be done so rapidly. From 15 seconds to 1 minute will give a deposit of extraordinary toughness and of the desired color. It is believed that the advantage of such a solution will be fully appreciated by platers when it is realized that several days may be consumed in producing a good verde-antique finish by the corrosion process on copper or bronze.

The process is not merely a laboratory product, but is commercially successful and is already a valuable contribution to science. Not only is it adapted to the coloring of art metal wares, lamps, chandeliers and all kinds of ornamental objects, but has found a direct application in the manufacture of leaded glass. In this instance, the glass, being a non-conductor of electricity, is not affected in any way and the lead is colored to match the glass or to set it off with some harmonizing color.

The hardness and toughness of the deposit is remarkable as it is soon found that waxes or lacquers are unnecessary in its preservation.

A comparison of the process with that of the well known corrosion method of producing the verde-antique finish indicates the great value. In the corrosion process it is possible to produce the color only on brass, bronze or copper surfaces. The results are not uniform and uncertain. Doing over is unsatisfactory and difficult. The color is soft and lacquering is required. The time is also very important factor as many hours are consumed.

When the Rojas process is used, the deposit can be put directly on any metal without the necessity of depositing a preliminary coating. Iron, steel, copper, lead, silver or any other metal can be used. The results are very uniform and reliable and are independent of atmospheric changes. Doing over is very easy and is rarely necessary. The color is so hard that no lacquering is required and the whole operation consumes but a few minutes.

Brass Tray Finished in Verde-Antique by the "Rojas" Process in 1 Minute.

The solution is sold by the manufacturers ready for use and from 6 to 10 volts are required in the electrodeposition. Carbon anodes are used. At the present time three standard plating baths are sold: 1. Deposits a hard, verde green color. When relieved through to the metal there is no intermediate shade.

2. This solution deposits a hard, black bronze in one immersion with a verde smut over it. The smut may be relieved to the black underbody completely, or only on the high lights.

3. Deposits at one immersion a regular bronze with a verde smut over it. The smut

is so hard that it may be brushed with a tampico brush and left without lacquering or waxing. By means of a softening dip, the smut may be relieved on the high-lights. Thus with this one solution, three standard finishes may be produced: All green, all bronze, green ground color with bronze high lights. This solution is recommended for general use.

Any number of pieces may be plated at one time in the solutions and the operation is carried on like any regular plating process. The solutions do not deteriorate and can be used continuously for any reasonable length of time. It is stated by the manufacturers that the cost of doing work by means of the solutions is about one cent per square foot.

Secondary effects may be produced after depositing the various colors in the regular solutions. These effects are obtained by means of coloring dips into which the smut is immersed after plating. By means of this dip practically every color can be obtained and this is one of the remarkable features of the process. It will readily be appreciated, therefore, how elastic the process is and how it is possible to obtain any desired shade of color on work that will be durable and permanent.

The Rojas Electrichemical Co. has been organized at 516 West 25th. St., New York City to market these solutions and from whom information can be obtained. They will be pleased to demonstrate their process and will be pleased to finish samples of work sent in to them to show the process to any who may wish to see it at their works. The present officials of the company are F. Arquimedes Rojas, president; Ralph B. Schoonmaker, vice-president; R. D. Schoonmaker, treasurer; and Carl S. Brown, secretary.

Sal-ammoniac has been shown to be a better addition agent for a nickel plating solution than sodium chloride (common salt) as it has a higher electrical conductivity.

Electrogalvanizing has proved to be a very satisfactory protection to iron and steel from rust. It has not been found a competitor of hot-galvanizing to any extent, but has replaced other metal coatings such as nickel and copper. As a protection against rust, however, it has been found far superior to these metals.

A Simplified Lead Plating Bath.

While the electrodeposition of lead is not extensively carried on there are times when it is necessary and, therefore, a satisfactory solution must be employed for the purpose. The usual solution for the electrodeposition of lead is made by boiling litharge (yellow oxide of lead) with a solution of caustic potash for some time until a portion of the oxide dissolves. This operation is quite unsatisfactory for the reason that unless quite a small quantity is made, platers have no facilities for boiling a solution of this kind and it cannot be done cold. To be sure, the solution gives as good results as the one to be described, when properly made up, but not only is it difficult to make up any considerable quantity, but the amount of the oxide of lead dissolved by the potash varies with the temperature of the solution and the length of time the boiling is carried on.

The following solution is not a radical departure from the preceding one; in fact, it differs only in the use of acetate of lead (sugar of lead) in place of the litharge (or oxide of lead), and by the use of this different lead salt, it is possible to make up the solution cold. Sugar of lead, of course, is soluble in cold water and when added to a potash solution, lead hydroxide is first formed as a white precipitate and then dissolved by the excess of lead. The solution is made up in the following manner:

Water	1 gallon
Caustic Potash	5 oz.
Sugar of Lead	1½ oz.

Dissolve the sugar of lead in half of the water and the caustic potash in the other half. Then mix the two. Stir and a white precipitate of lead hydroxide will form. This, however, is soon dissolved and a clear solution results. If it does not dissolve readily in cold weather, a slight warming will soon cause it to go into solution, but this is unnecessary as it dissolves readily.

A clear solution is thus had and which is ready for use. A piece of sheet lead is used for the anode and the solution used cold. A current of from 3 to 4 volts is necessary for the electro-deposition of the lead which is just enough to cause a slight evolution of gas.

The first deposit of lead, which is simply a "flash" coating, is bright, but it rapidly becomes dead and if carried on long enough it becomes spongy. For this reason the deposition cannot be carried on for any length of time without taking out the article, upon which the lead has been deposited, and scratch-brushing it with a brass scratch brush, in order to remove the spongy nature of the lead coating. The article may then be returned to the solution and another deposit put on. By carrying this out from time to time a very heavy lead deposit may be obtained.

For ordinary purposes, a lead deposit sufficiently heavy may be obtained in from 5 to 10 minutes or just before it begins to become spongy. Even in a few minutes a lead coating sufficient for some purposes can be produced.

Why Fused Nitrate of Silver Should Be Used.

Nitrate of silver is extensively used in electroplating and in chemistry and the usual method of making it is to dissolve metallic silver or the so called fine silver (which is simply pure silver) in dilute nitric acid. When dissolved, the solution is evaporated and the nitrate of silver crystallizes out.

By redissolving these crystals in water and evaporating again, it is possible to obtain them pretty free from acid, but unless this is done and the first crop of crystals are used they are quite acid, so much so, in fact, that they cannot be used for some operations.

In making test solutions, nitrate of silver is used and it must be pure and free from acid. In order to do this, it should be fused. The nitrate of silver crystals are placed in a porcelain dish and heated until they melt. It will be found that they melt down to a clear liquid. No further heating is required. Any free nitric acid and moisture will be driven off by this heating. The nitrate of silver, when it cools will be white and pure and is readily broken up for use.

The fusing of nitrate of silver is so easily accomplished and the fused material thus obtained is so pure, that it is to be recommended when a good article is desired and one that can be used for every purpose.

Need of Using a Large Quantity of Steel Balls in Burnishing by Tumbling.

The increasing use of steel balls for burnishing small metal goods by tumbling calls for some remarks upon the necessity for using a large quantity in the process, as it has been discovered that there is a strong tendency in the trade, particularly among the smaller manufacturers, to attempt to economize on the balls and use too few. The result is that not only is it difficult to obtain a good burnished surface on the goods, but the manufacturer usually condemns the ball burnishing process.

The theory of ball burnishing by tumbling is that each ball acts like a hardened steel burnisher and rolling over the surface of the work, actually burnishes it. Unfortunately, the ball is not capable, on account of lack of pressure, of burnishing as rapidly as a hand burnisher for the reason that in the latter instance, considerable pressure is brought to bear upon the burnishing tool so that the surface of the metal is burnished down rapidly. When balls are used, however, the burnishing is naturally slow for the reason that only the weight of the ball itself presses against the surface. In order to accomplish the necessary burnishing, therefore, the ball must pass over the surface of the metal many times.

If a small quantity of balls are used, they do not come in contact with the surfaces of the work being burnished as often as necessary and hence the burnishing is slow. In fact, if a small quantity only of balls are used it may take so long to accomplish the results that the surfaces of the articles being burnished coming in contact with one another, instead of with the balls, are actually abraded instead of burnished.

When, therefore, a large quantity of balls are employed in the tumbling barrel, there is a constant rolling of the balls over the surface of the work and the burnishing takes place rapidly. In an establishment doing some excellent work by means of steel balls, it is customary to use about twice the quantity of steel balls that there is work in the barrel. This gives ample opportunity for them to act on the surface.

Manufacturers who are desirous of burnishing their metal goods by means of steel balls,

should not attempt to economize too much on the steel balls as it will be found far more economical in the end to use the quantity necessary for rapid and satisfactory work.

An Improved Zinc Coslettizing Process.

An improvement in "Coslettizing" has recently been patented by Thomas Watts Coslett of Birmingham, England. This process differs from that previously used in that zinc is employed in connection with the phosphoric acid. The ordinary process of "Coslettizing" consists in boiling the articles of iron or steel in a solution of phosphoric acid and phosphate of iron in water. Phosphoric acid may be used alone but a longer time is required in order to produce the coating as a certain quantity of iron must be in the solution to give the deposit. No electric current is used, and simply a boiling or heating operation is carried on. By this method a dead, black coating is produced on iron or steel which protects it from rusting.

In the new process previously mentioned, the following solution is first made up:

Zinc	6 oz.
Phosphoric Acid	1 pint
Water	1 pint

The solution is warmed for dissolving the zinc and is then known as the "concentrated solution." This solution is then added in the following proportion to water to produce the solution intended for regular use:

Water	1 gallon
Concentrated Solution	1 oz.

For renewing the solution when in use, ¼ oz. of the concentrated solution is added to each gallon.

The iron or steel articles to be treated are boiled in the solution, contained in an iron kettle, for some time (usually about an hour) and a rust-proof coating is obtained on the surface. The process may also be combined with the other in which phosphate or iron is used and a combination coating obtained. The inventor states that an electric current may also be used in the operation in order to hasten it. In this case, the solution may be used cold if desired. The article to be treated is made the cathode and an iron plate is used as an anode.

Note on the Parting of Platinum and Silver.

The method of parting the platinum-silver button (obtained in the assay of platinum) by means of concentrated sulphuric acid, is inaccurate, says A. Steinmann in *Chem. Zentr.*, because boiling concentrated acid dissolves considerable quantities from platinum and platinum-silver alloys. The loss is usually 20 to 30 parts per 1000 parts of platinum, but may be as much as 50 parts.

By using slightly diluted sulphuric acid, the silver can be extracted without loss of platinum. The following method is proposed:

About 250 mgrms. of the platinum alloy are mixed with silver (at least 5 times the quantity of platinum present), copper and lead. The quantity of copper to equal that of the platinum. The whole is then cupelled in a muffle furnace at as high a temperature as possible and the button obtained fused from 5 to 10 minutes. The resulting button is then rolled to a thickness of 0.2 mm. and heated for 15 minutes with diluted sulphuric acid (100 volumes of concentrated acid to 22 volumes of water) at a temperature not exceeding 240° C. The treatment with acid is repeated twice, and residual platinum is washed, dried and weighed.

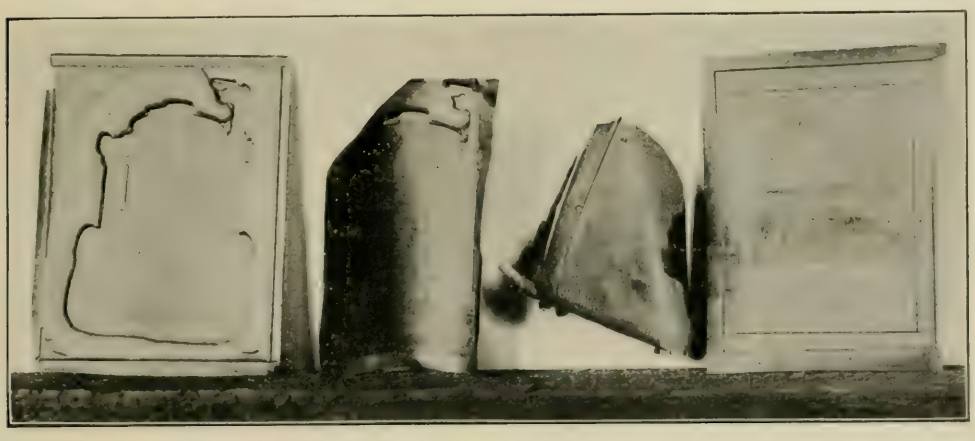
Note on Electroplating Stoneware.

In *Electrochem, Zeitung,* G. Strahl makes the following remarks upon electroplating stoneware. He says: "The difficulty in electroplating stoneware lies in producing on the latter a durable conducting layer. This may be effected by applying to the ware a mixture of birch-oil, asphaltum petroleum and "gold-graphite", and afterwards burning in a muffle to 200° C. "Gold-graphite" is made by mixing 2 grams f pure gold chloride with 10 grams of potassium cyanide and water and adding 1 gram of pure graphite, and then burning to 600° C. in a muffle. A mixture containing 12 parts of "gold graphite" to 5 parts of petroleum is recommended. The final burning of the ware should be strongly reducing in order to form a carbon deposit in the outer layers of the pottery, this being said to promote the tenacity of the metallic deposit.

Some Examples of Curled Nickel Deposits (Nickel Electrotypes).

The peeling of nickel deposits is usually attributed to lack of cleanliness on the surface of the work plated, and this is undoubtedly the cause in the majority of instances. Platers do not experience as much difficulty at the present time, however, from the peeling of nickel deposits as they did years ago for the reason that they have learned to keep the solution acid instead of alkaline with ammonia. If ammonia predominates, however, the deposit will usually peel after it attains any reasonable thickness and often while in the solution.

A subscriber recently sent us some examples of curled nickel deposits that are quite interesting on account of the fact that they are heavy ones and on this account are suitable for indicating the curling phenomenon. The nickel deposits were made in the manufacture of nickel electrotypes and it was necessary, on this account to make them heavy.



A B C D

Nickel Electrotypes, Showing Curling Effect On Account of Solution Having Become Lean in Nickel.

The solution used was made up from double nickel salts in the usual manner and the electrodeposition of the nickel on a wax impression begun. One of the first electrotypes made is shown as "A" and when removed from the wax was in a flat and fairly tough condition. Nickel deposits, of course, are not pliable like copper, but the first electrotypes were much softer than the ones finally obtained when they curled badly. After the solution had been used for some time, the electrotypes began to curl. It had then been in use for about a week. An electrotype shown as "B" is the result of the electrodeposition in this used solution. The manner in which it curls should be noticed. The solution was then used for some time and the result was even worse than before. The electrotypes curled worse than previously. One of them is shown in "C".

The solution was then rejuvenated by the use of single nickel salts and neutralizing the excess of acid in it with the result that the deposit was flat, although not as good as the one obtained from the original solution. This is shown in "D".

The cause of the excessive curling of the electrotypes was undoubtedly hydrogen absorption. It is a well known fact that nickel deposits absorb hydrogen gas, when it is given off from the surface of the article plated, and this hardens the deposit and renders it brittle. Hydrogen gas is always given off to a greater or less extent in nickel plating, but when everything is going along normally, the quantity given off is so small as to be practically invisible to the eye. If the solution is not in good condition and a strong current is employed, then a greater quantity is evolved. In the case of the electrotypes, the solution worked all right when first made, indicating that the current strength was right and the solution in good working condition. After a

time the nickel deposits began to curl. The solution had then changed and this change was as follows:

In the manufacture of electrotypes, metal is deposited very rapidly, and in the case of nickel, usually more rapidly than the anodes feed the solution, particularly when too small a number of anodes are used. The result is that the nickel in the solution becomes exhausted, sulphuric acid is set free and sulphate of ammonia becomes predominant. Under these conditions, the nickel deposits rather slowly, much gas is given off from the surface of the deposit and the nickel absorbs hydrogen and becomes brittle and curls. This is particularly true when it is found that the nickel is depositing rather slow and the current strength is increased. The hydrogen gas given off is, accordingly, increased and a brittle, curled deposit results.

To "doctor" a nickel solution that gives a curled deposit, the following method should be adopted: The free acid is neutralized by the use of nickel carbonates (plastic). This will form nickel sulphate and add nothing else to the solution. When this has been done and the solution neutralized, there will be no need of adding anything else as the solution itself has been brought back to its original state by the nickel carbonate. No single salts will be required as they are formed by the nickel carbonate and free sulphuric acid in the solution, reacting with one another and forming nickel sulphate (single salts).

Effect of Temperature Upon the Ductility of Zinc.

In the *Proclamation of the Royal Society*, 85, 1911. W. B. Hains describes experiments made to determine the effect of temperature upon the ductility of metallic zinc. The results of the experiments are as follows:

Commercial zinc wires, containing a small proportion of lead, were fixed vertically in a bath of castor oil and stretched by a weight applied to the upper end by means of a pulley; a cathetometer being used to measure the extension of the wire. At each temperature, the rate of extension was calculated from observations for several loads ranging up to the breaking stress.

It was found that between 80° and 90°C. (176° and 194°F), the metal becomes remarkably soft: as soft, in fact, as it is at 150°C (302°F.). At a few degrees above 90°C (176°F), a hardening of the zinc sets in, which is so rapid that at 110°C (230°F), the behaviour is comparable with that at 30°C. (86°F.). There is, however, great brittleness at this lower temperature. From 110°C. (230°F.) onward, there is a regular softening as the temperature rises, up to 200°C. (392°F.) and probably at least up to 250°C. (482°F.). This hardening in the region of 100°C. (212°F.) takes some time to develop. The effect of heating the wire to temperatures above 120°C. (248°F.) and then cooling, is to diminish greatly its tenacity and ductility, through the induction of a crystallize structure. It can be restored to its former condition by hammering. Experiments on bars of pure zinc failed to show these changes in the region of 100°C. (212°F.), the only pecularity being the hardening in the region of 200°C. (392°F.).

Cupro-Vanadium and Alumino-Vanadium.

As we have received numerous requests for information in regard to the copper and vanadium alloys, together with prices for same we take pleasure in herewith publishing a letter from the Vanadium Sales Company, Frick Bldg., Pittsburgh, Pa., who are now producing alloys of copper and vanadium and aluminum and vanadium:

Editor:

Beg to acknowledge receipt of your letter of the 22nd. requesting price of an alloy of copper and vanadium running from 5 to 10 per-cent of vanadium, and replying thereto wish to advise that we do not make any alloy of these two metals running 10 per-cent in vanadium. We have an alloy known as cupro-vanadium which contains from 2 to 5 percent of vanadium, and which sells for $1.50 per pound gross.

We also make an alloy for application to non-ferrous metals, known as alumino-vanadium, which runs about 10 per-cent in vanadium. The price of this alloy is $1.50, gross.

Awaiting your further commands, beg to remain,

Yours respectfully,

VANADIUM SALES COMPANY OF AMERICA.

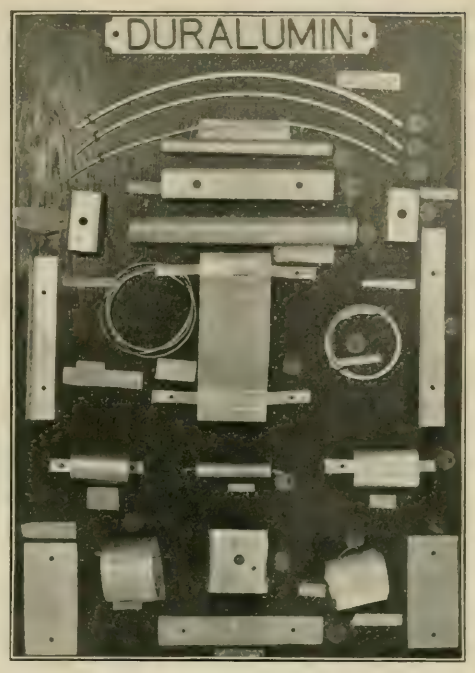
Pittsburg, Pa., Nov. 25, 1911.

"Duralumin" and Its Properties.

One of the new aluminum alloys that has appeared on the other side of the water within the past year, is a material called "Duralumin". It has created a large amount of interest in England and on the Continent; but owing to misinformation about it in the United States, the wrong impression has already been created here.

Let it be understood that "Duralumin" is not used for castings, but is made only in the form of sheet, rods and wire and tubes. The manufacture of this material involves a special process of hardening it in the above forms and this constitutes the secret of manufacture. The strength of the rods and sheets are much higher than can be obtained on ordinary aluminum or aluminum alloys.

"Duralumin" is now being placed on the American market by the American Duralumin Company, Hanover Bank Bldg., New York City who will supply all grades of material. They have supplied us with the following information in regard to the strength and physical properties of the material:



Examples of Duralumin Products.

Quality	Tensile Strength Lbs. Sq. In.	Elastic Limit	Elong.	Hardness*
H	51,530 to 80,640		25%	98
A	58,240 to 89,600	31,360	20%	109
B	62,720 to 96,320	33,600	19%	118
C	64,960 to 100,800	35,840	18%	123
D	64,960 to 103,040	38,080	18%	125

The two figures given for the tensile strength are those of the hard and soft materials. The elastic limit of the hard material is always much higher in proportion to its tensile strength. For example, the ultimate strength of "H" hard, with a breaking load of 64,960 lbs., would have an elastic limit of about 49,280 lbs. per sq. in.

The specific gravity of "Duralumin" is 2.8 and 1 cubic inch weighs 1.623 oz. The coefficient of expansion of all grades of the material is 0.000023. The melting point is 650° C.

The effect of acid on "Duralumin" is given as follows. The metal was soaked for one week:

Hot Dilute Sulphuric Acid	3.34% Loss
Cold Dilute Sulphuric Acid	1.52% Loss
Cold Conc. Sulphuric Acid	3.24% Loss
Cold Conc. Nitric Acid	1.07% Loss
Cold Dilute Nitric Acid	0.71% Loss

"Duralumin" in the form of sheet spins well, but requires special annealing and rehardening. The American Duralumin Co, is not equipped for this process at the present time.

"Duralumin" is non-magnetic and mercury does not affect it. Its resistance to corrosion to ordinary sea-water is extraordinary. A test of 75 days duration of different qualities of "Duralumin" showed no corrosion whatever, while aluminum, under similar conditions showed a loss of 50%. It is stated that the material does not crystallize.

The aluminum-bronzes and the tin-bronzes can be increased in tensile-strength by quenching in water at a red heat. It is probable that all the non-ferrous alloys are so affected, but experiments have not been made to determine it.

*Brinell Test.

"Trisalytes," the New Salts for the Electrodeposition of Metals.

A new class of salts for the electrodeposition of metals has lately made its appearance upon the American market. They are called "Trisayltes" from the fact that they are triple salts of the metal to be plated with sodium cyanide. It is well known in chemistry that triple compounds of stable composition are quite common and are as readily made as the double or single salts. Heretofore, however, they have not been used in electroplating. The advantage of these triple salts is that they can be made of uniform quality that will always be of the same, identical composition, and they are free from chlorides which are often objectionable in a plating bath. By the use of these triple salts, errors caused by the addition of incorrect proportions of the ingredients is eliminated so that the plating solution will remain constant and uniform in its composition and insure uniform results in plating.

The following table shows the amount of metal contained in the "Trisalyte" salts as manufactured:

Copper Trisalyte always contains	.....	24-25%	.....	Metallic	Copper
Zinc	"	"	"	.....	18-19%	.....	"	Zinc
Gold	"	"	"	.....	40%	.....	"	Gold
Silver	"	"	"	.....	30%	.....	"	Silver

Some of the advantages of these salts are the following:

1. Safety. With the use of Trisalytes the disagreeable and often dangerous fumes are entirely eliminated. Trisalytes are absolutely safe to handle and use.

2. Simplicity. As Trisalytes are readily soluble in either warm or cold water the usual elaborate preparations are unnecessary. It is only necessary to add the proper proportion to water to obtain a colorless bath of maximum purity and conductivity.

3. Uniformity. Trisalytes are invariably of the same chemical composition so that the metal contents of the bath can be readily regulated. Thus, also, errors arising from the addition of incorrect proportions of ingredients to the bath are eliminated.

4. Economy. Not alone are Trisalyte baths cheaper in cost but as the metal is drawn more freely from the anodes the life of the baths is greatly increased. The baths can be readily revived by the addition of Trisalytes without the precipitation of objectionable salts.

Directions for Preparing Plating Solutions by Means of "Trisalytes".

The fundamental rule for all electro-plating well known to all platers is, that the surface of the goods to be electroplated must be *thoroughly cleaned,* before they are introduced into the bath. Trisalyte baths, as also electrolytic baths made up with cyanide from older recipes, can be restored completely with a quantity of Trisalyte in proportion to the degree of their exhaustion.

COPPER SOLUTION. For heavy and also light plating of all metals and sizes for a bath of 25 gallons.

Copper Trisalyte ..... 10 lbs.
Water, cold ..... 25 gallons

Temperature of bath 15-20° C. or 60-70° F.

Voltage for a distance of 6 inches from anodes to goods:

For Iron, 3 volts.
For Zinc, 3½ volts.

Change of voltage for each 2 inches anode-distance 0.30 volts.

The quantity of Copper Trisalyte in above bath can be increased up to 23 lbs. in order to obtain quicker working. For iron and lead goods, also lead alloys, an addition of 4½ lbs. sulphite of sodium (dry) and 2¼ lbs. carbonate of sodium is of advantage.

As anodes, preferably electrolytic copper or of other pure copper are to be used. If after working, the anodes become covered with a thick green mud, cynaide of sodium 129% has to be added to the bath. A light coating of this mud on the anodes may stay while working.

BRASS SOLUTION. For a brass bath of 25 gallons for large or small sized goods.

Copper Trisalyte ..... 11 lbs.
Zinc Trisalyte ..... 5½ lbs.
Water, cold ..... 25 gallons
Aqua Ammonia 25% (According to shade wanted) ½-1¼ lbs.
Temperature of bath: 15-20° C, or 60-70° F.

Voltage at an anode distance of 6 inches from anodes to goods:—

For Iron, 3 volts.
For Zinc, 3½ volts.

Change of voltage for each inches anode-distance 0.25 volts.

For anodes soft cast brass or soft sheet brass has to be used, containing 70 parts electrolytic copper or other pure copper and 30 parts electrolytic zinc or pure zinc.

If the anodes become covered with a thick green mud after some time, cyanide of sodium, 129% has to be added to the bath. A very light formation of mud on the anodes may stay during working.

For brass plating of goods of iron, lead and lead-alloys, an addition of 4½ lbs. sulphite of sodium (dry) and 2¼ lbs. carbonate of sodium (dry) is of advantage.

BRONZE SOLUTION. For a bronze solution of 25 gallons for large or small work:

Copper Trisalyte	14	lbs.
Zinc Trisalyte	4 2/3	lbs.
Water, cold	25	gallons
Aqua Ammonia	7	ozs.

Temperature of bath 15-20° C or 60-70° F.

Voltage at a distance of 6 inches from anode to goods;—

For Iron, 2.9 volts.
For Zinc, 3.25 volts.

Change of voltage for each 2 inches anode-distance 0.10 volts.

As anodes, those of soft cast brass are used, consisting of 85 parts electrolytic copper and 15 parts of electrolytic zinc (or other pure copper and zinc.)

Bronze baths also need an addition of cyanide of sodium 129%, if the anodes get covered with a thick mud.

By changing above proportions of Copper-Trisalyte and Zinc-Trisalyte all shades can be obtained from the lightest brass to the darkest tombac.

Furthermore, by changing or regulating the voltage by the bath current regulator, using higher or lower voltage, lighter and darker shades can be obtained in both brass and bronze baths. The size of anodes in copper, zinc and bronze baths should always be equal to the surface of the goods. The given voltage is meant for this.

These formulas have been practically tested and can be taken as types. Of course, according to the electrolytic facilities, practical changes can be made.

ZINC SOLUTION. A good zinc solution is obtained by dissolving

Zinc Trisalyte	13 lbs.
Water, cold	25 gallons

Temperature of bath 15-20°C. or 60-70° F.

For goods of cast iron an addition of 4⅛ lbs. sulphite of sodium (dry), 2¼ lbs. carbonate of sodium (dry) and 1⅛ lbs. of ammonia (0.910) is of advantage.

Regarding the voltage, the same rules are to be followed as for Copper-Trisalyte.

For anodes, electrical zinc or pure refined zinc has to be used. If there is no longer sufficient cyanide in the bath, which can be noticed by a coating on the anodes, cyanide of sodium, 129% has to be added from time to time.

GOLD SOLUTION FOR LIGHT PLATING. Zinc and tin goods, also alloys are preferably copper plated before gold plating.

Zinc and tin goods, also alloys, are suitably copper-plated before gold-plating.

Gold Trisalyte (40% Fine Gold)	1.4 ozs.
Phosphate Sodium c.p	8.4 ozs.
Cyanide of Sodium 129%.....	1.6 ozs.
Water, Condensed or Boiled ...	5 gals
Temperature of bath .....120-160° F.	
Voltage at a distance of 6 inches from anode to goods; abt.	3 volts
Change in voltage for each 2 inches distance	0.1 volts

GOLD SOLUTION FOR HEAVY PLATING. Zinc, tin or lead alloys should be copper plated before gilding.

Gold Trisalyte	2.4 ozs.
Phosphate Sodium, c.p	6.7 ozs.
Cyanide of Sodium 129%	1.6 ozs.
Water, Condensed or Boiled	5 gals
Temperature of bath .....120-140° F.	
Voltage at a distance of 6 inches to goods	2.5 volts
Change of voltage for each 2 inches distance	0.15 volts

Size of anodes about 1/3 larger than surface of goods.

For Gold-Trisalyte baths it is advantageous to use anodes of fine gold.

It is also possible to use platinum or carbon anodes, but it is better to wrap the carbon in a bag of colorless raw-silk.

The surface of the carbon anode should be ½ times larger than the surface of the goods,

and at the same time voltage has to be increased to about 3 volts.

If the gold anodes turn to a dark discoloration, while working,

Cyanide of Sodium 129%

has to be added carefully and gradually.

The consumption of gold has to be compensated from time to time with Gold Trisalyte, in case platinum or carbon anodes are used. When gold anodes are used, it is not necessary to restore the gold in the bath as often.

Gold-Trisalyte baths give brilliant deep shades for mat gold as well as for bright gold, and also for antique gold provided that the voltage is correct.

It has to be considered that higher voltage gives darker, and lower voltage lighter shades.

With above Gold-Trisalyte baths, very good results are also obtainable with the dipping process (190-212° temperature of bath).

For strong and quick working increase the quantity of fine gold to 0.14 ozs. fine gold (equal to 0.35 ozs. Gold Trisalyte) per quart. This strong gold bath is also very suitable for contact-plating, with zinc sticks if from

0.06-0.14 ozs. Cyanide of Sodium 129%

is added to per qt. of the bath.

Combinations of Gold-Silver and Copper-Trisalyte in the bath enable us to obtain the most different variations in color.

So by an addition of Copper-Trisalyte, in different proportions, to the pure gold bath, any kind of red gold can be obtained; by addition of Silver-Trisalyte all kinds of green gold, and by addition of silver and Copper-Trisalyte a pink-gold color.

SILVER SOLUTION. For light plating of all metals.

Silver Trisalyte (30% Fine Silver) 13.5 ozs.
Water, Boiled or Distilled, Cold .... 5 gals
Temperature of Bath .....60-70° F.
Voltage at 6 inches distance between anode and goods ..... 2 volts
Change of voltage for each 2 inches distance ..... 0.3 volts

Anodes of fine silver have to be used. If the anodes get black by using after a certain time or if muddy sediments are formed at normal voltage,

0.06-0.14 Cyanide of Sodium 129%

has to be added carefully per each qt. of bath.

Baths made up with Silver Trisalyte can also be used without electric current, i. e., for the so-called dipping process, if

0.14-0.27 oz. Cyanide of Sodium 129%

is added for each qt. of the bath. In this case the temperature is about 194° F.

SILVER SOLUTION for heavy plating of copper, brass, German-silver and similar articles, as well as brass plated iron, zinc, antimonial-lead, britannia-metal, etc.

Silver Trisalyte ..... 2 lbs. 2 ozs.
Water, Distilled or Boiled, Cold 5 gals.
Temperature of bath .....60-70° F.
Voltage at an anode distance of 6 inches ..... 1.5 volts
Change of Voltage for each 2 inches distance between anode and goods ..... 0.5 volts

Other rules same as above mentioned, for light plating.

SILVER SOLUTION for light plating by Weight.

Silver Trisalyte ..... 3 lbs. 6 ozs.
Water, Distilled or Boiled, Cold 5 gals.
Temperature of bath .....60-70° F.

The "Trisalyte" salts for plating have been used in Germany for a sufficiently long time to thoroughly demonstrate their value. They are now being manufactured in the United States by the Roessler & Haaslacher Chemical Co., 100 William St., New York City. The salts of copper and zinc "Trisalyte" are put up in 1 lb., 5 lb., 10 lb., 25 lb. and 100 lb. tins, while the silver and gold salts are sold in 1 oz., 2 oz., 4 oz. and larger sized bottles.

Foundry Patterns.

At a meeting of the Lancashire Branch of the British Foundrymen's Association at Manchester on November 4, Mr. T. R. Schofield read a paper on "Pattern Making to Modern Requirements." Developments in the engineering trade and the need for interchangeability of parts of machine tools had made it necessary to produce castings of the greatest intricacy and precision. It was therefore necessary, the lecturer said, to consider the position in which the pattern-shop stood to these developments. Patterns had been regarded as dead money. This was true in a certain sense; but it was no reason for assuming an attitude of grudging intolerance towards the pattern-shop and neglecting its claims to be properly equipped on modern lines. The pattern-shop and the foundry should be considered together, and apparent economies in the former

weighed against their effect in the foundry. The surface-table, the angle-plate, and the scribing block were indispensable for marking out castings in the fitting-shop. The surface-table should be as big as possible. It often happened that for want of appliances in the pattern-shop, while the casting was set out in the most rigid manner, the pattern, on whose accuracy the casting depends, was built up and set out in the crudest way. Again, the lathes provided should be well up to date, for turning occupies a good deal of time of the pattern maker. A long time ago, some evil genius decided that any apology for a lathe was good enough for the pattern-maker, and this tradition still held in many places. A circular-saw bench of suitable design should be added to the equipment, and would help materially to keep down the cost of the patterns. In analysing pattern work the lecturer distinguished the principal elements as follows:—(1) Design of pattern to most suitable method of making casting; (2) cutting up and preparation of timber; (3) setting out and building up; (4) turning of circular portion of pattern; (5) hand work of paring and carving with chisels and gouges; (6) rounding off, sandpapering, filleting, &c. With regard to the first point the lecturer thought that the foundry foreman should be consulted, as the man likely to know best, whether the pattern should be cored, whether parts should be loose or made fast with a covering core up to the joint face, whether drawbacks would be necessary, &c., &c. An intelligent use of the dimension saw was valuable in the getting out of the timber. In regard to the importance of finishing a pattern Mr. Schofield pointed out that a moulder respected a decent pattern and treated it more carefully merely because of its appearance.—*The Ironmonger.*

When metallic nickel is heated in an atmosphere of hydrogen gas to a temperature above its melting point, the gas is absorbed in a considerable amount, and upon cooling, it is expelled again. As much as 12 times the volume of the nickel may be expelled. This fact has a bearing upon the difficulty in obtaining sound nickel or nickel alloy castings. Gas is absorbed during melting and expelled upon solidifying leaving the casting porous.

The Difficulty of Plating Aluminum.

Nothing has ever bothered the electroplater like aluminum. Up to the present time, successful electroplating has not been accomplished, although many processes have been brought out from time to time. The difficulties are twofold: First, when cyanide solutions are used for plating it, blisters are sure to form and these seem to grow so that finally the whole layer of the deposit peels off. In

Nickel Plated Aluminum Sheet, Showing Peeling of the Deposit When Bent.

the case of nickel, blisters do not form but it is difficult to obtain the necessary adherence of the nickel deposit to the aluminum. In fact, it may be said to be impossible with our present knowledge.

In the illustration herewith shown is a sheet of aluminum that has an apparently good coating of nickel on it. In fact, the deposit looked well and buffed to a good color, but when the sheet was slightly bent, the nickel peeled off as shown. The adherence between

the nickel and aluminum was very weak. This weakness is manifest in all deposits and is apparently caused by the oxidation of the aluminum in the air. Oxide of aluminum being white is not detected, but it forms whenever the surface is exposed to the air.

The sheet herewith illustrated was submitted to us by a plater who believed that he had succeeded in nickel plating aluminum, but the illustration indicates that he has not been completely successful. Even with an apparently good deposit, peeling will take place after a time, although the deposit may not be bent at all.

The electroplatiing of aluminum is not a difficult proposition when the simple covering of the metal is only to be considered, but to produce a deposit that will adhere and last has not yet been done.

The Manufacture of Oxygen Gas.

A British oxygen company states that it has decided to erect an oxygen factory in Sheffield, where it is considered the growing demand for oxygen in connection with metal cutting warrants this extension. When the Sheffield plant is completed the company, which in 1908 had only three factories (London, Birmingham, and Manchester), will possess eight factories in the United Kingdom, all situated in centers where the demand for oxygen is important—at London (Westminister and Greenwich), Birmingham, Cardiff, Manchester, Sheffield, Newcastle, and Glasgow. These extensions are entirely due to the demand for cheap oxygen in connection with oxyacetylene welding and oxygen metal cutting. In view of the heavy freight charges on gas cylinders conveyed by rail, it is obvious that local sources of supply must tend to reduce the price of oxygen to the consumer. All the company's plants are of the modern liquid-air type, producing oxygen of a high degree of purity, and when the Sheffield plant is in operation their total output will be about 200,000 cubic feet a day. This supply is largely in excess of the present demand, but it is anticipated that this quantity may ultimately be required if the use of oxygen for metal cutting extends. The present average price of oxygen, supplied in cylinders, for industrial purposes is about £2 ($9.73) per cubic feet, but reductions are expected if the demand increases.—*Daily Consular Report.*

Bristol's Frictionless Ink Type Recording Instrument.

An illustrated description of Bristol's patented semi-transparent smoked chart recorder has been previously published and although these recorders are fundamentally simple in their construction and hundreds are in daily service there has been a call for a recorder in which the record is made with ink. To meet the demand for a frictionless ink type recording instrument to parallel the smoked chart recorder as near as possible in fundamental simplicity and accurately to record

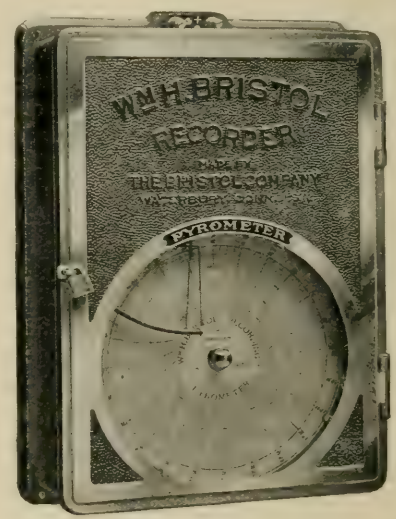


Fig. 1. Recorder Ready for Operating.

fractions of milli volts and adapted for use as a recording electric pyrometer, the instrument illustrated herewith has been developed and placed upon the market by The Bristol Company of Waterbury, Conn.

These instruments have been thoroughly tested out in practical service for two years past, and are the result of several years of study and experience with an original *patented design of a frictionless ink recorder using a hinged electrical movement carrying a retaining receptacle for marking fluid which extends over the path of the recording tip and is provided with means for periodically making contact with the source of marking fluid and the chart.

*Patented by Wm. H. Bristol April 13 ,1909.

Fig. 1 shows the recorder ready for operating.

Fig. 2 is an interior view showing the galvanometer movement case hinged to the back of the instrument and carrying the inking pad in front of the recording arm.

Fig. 3 shows the sensitive electrical movement swung to one side for convenience in removing the record and inserting a fresh

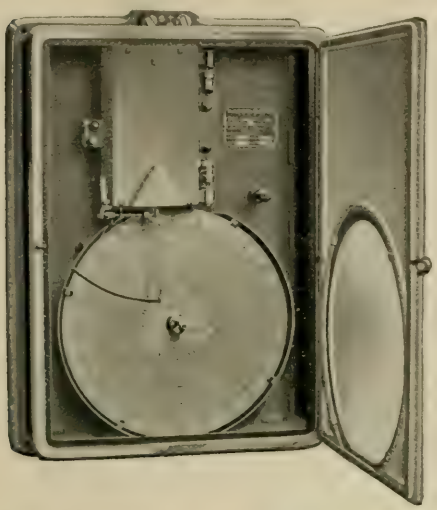


Fig. 2. Interior View with Galvanometer Case Hinged to Back.

chart. A capillary gold tube open at both ends is carried at the end of the recording arm at right angles to the surface of the chart. The

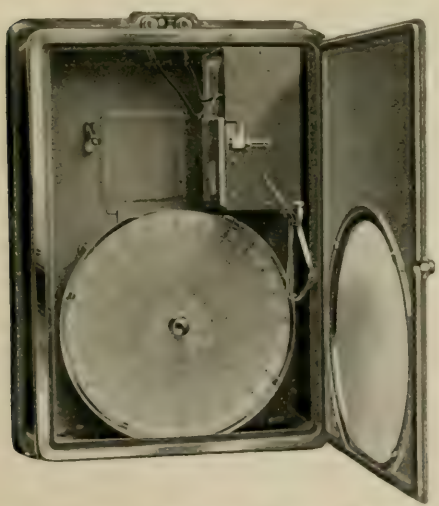


Fig. 3. View with Sensitive Electrical Movement Swung to One Side for Inserting Fresh Chart.

inking pad is suspended from the case of the electrical movement and is curved to correspond with the arc covered by the motion of the end of the recording arm.

When the movement is swung back into its operating position as shown in Fig. 2 the recording arm can swing free, accomodating itself to the position corresponding to the delicate current which is to be measured. The clock which revolves the chart at the desired speed also automatically presses the inking pad toward the chart every ten seconds, bringing one end of the capillary tube into contact with the chart and the opposite end simultaneously into contact with the inking pad. A fine dot of ink is left on the chart and the capillary tube is replenished with ink from the pad. The recorder thus carries a constant supply of ink, and its perfect balance, which is very important, is always maintained. The electrical movements used in these recorders are made especially for the purpose by the Weston Electrical Instrument Co.

Although the most important applications of these recording instruments have been for pyrometers, they have also been used for electrolytic research, recording voltmeters, and recording shunt ammeters.

A New Briqueting Material for Smelting.

A new process for briqueting materials for smelting has recently been patented by Max Glass of Vienna, Austria-Hungary. The application is more particularly in the smelting of copper bearing material that is rather rich in metal, such as grinding, chips etc.

The material is first treated with sal-ammoniac in solution so that all portions are covered. A 5% solution is employed and 1000 parts of the material are mixed with 10 parts of the solution. The mass is then mixed with quicklime and heated to about 212° F slowly, after pressing in the briqueting press in the usual manner.

The theory of the process, the inventor says, is that cupric oxide is formed on the surface of the metal which, in connection with the lime acts as a binder. The calcium chloride, in connection with the excess of lime, also forms an efficient binder. Such briquets, of course, are to be smelted in the usual blast furnace for the production of copper.

The Way Things are Done in England.

In our own country trade-mark or patent infringers are simply required, when beaten in the Courts to pay a specified sum of money and cease infringement. In England, a public apology is demanded. The following will indicate how far this is carried in the case of two concerns who infringed the trade-mark of "Delta-Metal". The matter is of interest as indicating how the case is settled without going to the Courts. As far as known there have never been any similar cases in the United States where public apology has been demanded in this manner. The subjoined apologies were taken from a recent number of a leading English periodical in which they appeared as an advertisement.

Messrs RANKINE COCKAYNE & COMPANY, LTD.
AND
THE DELTA METAL COMPANY LTD

APOLOGY.

To The DELTA METAL COMPANY, Ltd., of London & Birmingham,
incorporated under the Companies Acts, and having their Registered Office at Delta Works, East Greenwich, London, S.E.

WHEREAS WE RANKINE COCKAYNE & COMPANY, Ltd., of Regent Brass Foundry, 10 Bentinck Street, Liverpool, have on various occasions supplied as 'DELTA METAL," Metal which was not manufactured by or obtained from you and you have pointed out to us that our doing so was an infringement of your trade mark and other rights in the term "DELTA METAL," and have intimated your intention of commencing legal proceedings against us in respect of such infringement.

AND WHEREAS you have consented to refrain from taking such legal proceedings in consideration of our signing this Apology for publication, and paying you the sum of FIFTY POUNDS by way of nominal Damages, together with further sums in respect of your costs and the expense of advertising this Apology, which sums have been paid by us.

NOW WE, the said Rankine Cockayne & Company, Limited, HEREBY APOLOGISE to you The Delta Metal Company, Limited for having infringed your rights in manner above stated, and undertake in future not to repeat the infringements of which you have complained, or to apply the name "DELTA METAL" or "DELTA" in any way to Metal not manufactured or supplied by you AND we further agree that you shall be at liberty to publish this Apology as you may think proper.

DATED this Seventeenth day of November, One thousand Nine hundred and Ten.
PASSED under the Common Seal of the said Rankine Cockayne & Company, Limited, in the presence of
(Signed) W. COCKAYNE, } *Directors.*
(Signed) F. COCKAYNE. }
(Signed) A. H. COCKAYNE, *Secretary.*

Seal of the Company

MESSRS. THE BIRMINGHAM GUILD, LIMITED

APOLOGY.

To The DELTA METAL COMPANY, Ltd., of London & Birmingham,
incorporated under the Companies Acts, and having their Registered Office at Delta Works, East Greenwich, London, S.E.

WHEREAS WE, THE BIRMINGHAM GUILD, Limited, of 45 Great Charles Street, Birmingham, have supplied goods stated to be made of "DELTA SILVER BRONZE" and "DELTA METAL No. IV," which were not made of metal answering those descriptions, and you have pointed out to us that our so doing was an infringement of your trade mark and other rights in the terms "DELTA" and "DELTA METAL," and have intimated your intention of commencing legal proceedings against us in respect of such infringement.

AND WHEREAS you have consented to refrain from taking such legal proceedings in consideration of our signing this Apology, and paying you a Sum of Money by way of nominal damages and costs, which sum has been paid by us.

NOW WE, the said The Birmingham Guild, Limited, HEREBY APOLOGISE to you The Delta Metal Company, Limited, for having inadvertently infringed your rights in manner above stated, and undertake in future not to repeat the infringements of which you have complained or to apply in infringement of your rights the name "DELTA METAL" or "DELTA" in any way, to metal not manufactured or supplied by you under those descriptions AND WE further agree that you shall be at liberty to publish this Apology as you may think proper.

DATED this Third day of May, 1911
(Signed) C. A. LLEWELYN ROBERTS. } *Directors.*
(Signed) R. HUGH ROBERTS. }
(Signed) R. HUGH ROBERTS, *Secretary.*

Seal of the Company

Phosphor-bronze makes the best spring metal for the reason that it is not as apt to crystallize in service as yellow brass.

Brass is usually rolled in oil. In other words, the sheet is coated with oil before it goes through the rolls. The object is to reduce the power required in rolling as it has been found that the presence of the oil greatly reduces it. Metals rolled dry have a much better surface than those rolled in oil and some consumers specify "dry-rolling" for their product. Much greater power is then required and rolling mills do not like to roll metal in this manner.

Notes on the Peeling and Curling of Nickel Deposits.

K. Engemann in Zeitschrift für Electrochemie describes some experiments upon the cause of the peeling of nickel deposits and has arrived at some interesting results. He says:

"The tendency of electrolytic nickel to detach itself from the electrode in thin layers is usually due to the presence of traces of iron. From acid solutions of pure nickel sulphate and chloride, quite firm deposits are obtained even at a low temperature and a high current density. In ammoniacal solutions, however, the stripping is still marked even in the absence of iron.

When iron is present in the solution, it separates more rapidly than the nickel, so that the first layers contain more iron than the later ones. It is found that all conditions which are favorable to the stripping are those which cause the lack of uniformity in the ratio iron: nickel in successive layers of the cathode metal.

Low acidity and low temperature of the electrolyte increase the tendency to strip, while a gradual rise in current density first tends to promote and then retard stripping. The hardness of electrolytic nickel does not depend to any considerable extent on the use of the sulphate rather than the chloride, but the flexibility is greater when the sulphate is used. Increase in the acidity of the electrolyte, or the addition of a sodium salt causes an increase both in hardness and flexibility, when the other conditions are the same.

A New Form of Tilting Furnace for Brass Rolling Mill Work.

A new form of tilting furnace which is particularly applicable to the casting of brass in metal molds in the manner practiced in brass rolling mills, has been patented (U. S. Patent 1,008,406, Nov. 14, 1911) by Merrill Davis of Watertown, N. Y., and the patent has been assigned to James B. Wise of the same city, the well known manufacturer of plumbers' brass goods.

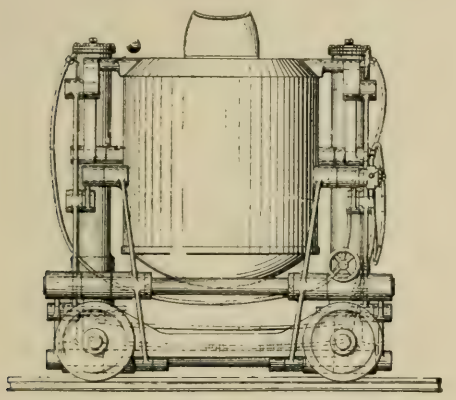


Fig. 1. Front View of the Furnace.

The furnace has been designed to obviate the difficulty heretofore experienced in tilting furnaces in pouring into stationary molds, such as those employed in casting brass for rolling. These molds are made of cast-iron and are long and narrow. As the ordinary tilting furnace rests upon trunnions, the spout, through which the metal is poured, describes an arc of

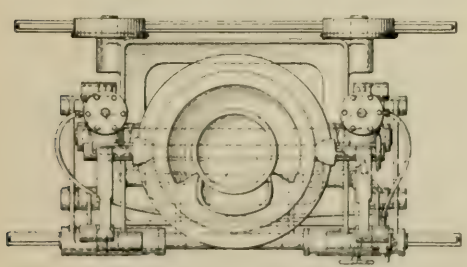


Fig. 2. Plan View of Furnace.

a circle when the metal runs into the mold. This fact renders it impossible to pour in the ordinary manner unless a basin is used or some device for moving towards or from the furnace is had. Brass manufacturers have not seen their way clear to do this.

In the invention herewith described, the furnace is mounted on trunnions, but is provided with a lifting device of an ingenious nature, so that the furnace may be poured into a mold in the same manner that would be carried out with a crucible when poured with tongs. This furnace is shown in Figs. 1, 2 and 3. In Fig. 1 an upright front view is shown, while in Fig. 2 is illustrated a plan

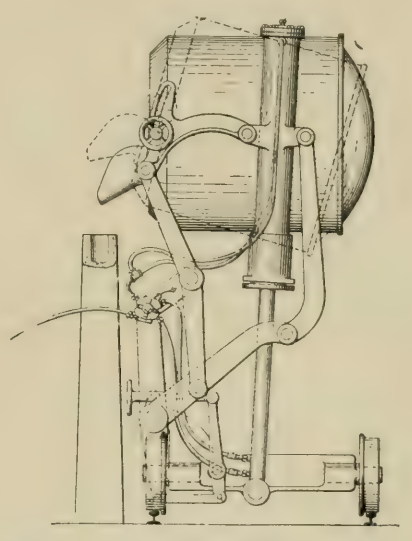


Fig. 3. Furnace Raised Ready for Pouring.

view. In Fig. 3 the furnace raised and in pouring position is shown. It is mounted on wheels so that it may readily be moved from place to place and poured without the necessity of using a ladle.

No claim is made upon the fuel used in the furnace and any kind, the inventor says, may be employed. The tilting is accomplished by means of a combined hydraulic and compressed air mechanism in which the actuating means is the compressed air, but instead of water in the hydraulic chamber, oil is used. The mechanism used to raise and tilt the furnace is arranged so as to be very readily operated by the melter and the pouring of the metal into the mold is then rendered positive. It is claimed that the pouring of the metal into molds may be accomplished with the same degree of accuracy that is obtained in pouring from a crucible. If desired, the furnace may also be used for pouring sand molds.

Eliminating Risers on Castings.

In order to allow for the shrinkage in castings of all kinds it is necessary to have a "feeder." In the case of small castings, the gate acts as a feeder. Heavy castings require risers. In either case, the principle is the same. The gate or risers, being of greater volume than the casting itself, remain liquid longer so that when the casting cools, it draws from it and is fed. Some metals require very heavy risers and manganese-bronze or aluminum-bronze are examples. Others, such as the tin-bronzes frequently may be cast without risers, on account of the less shrinkage, but wherever heavy portions are situated it is always wise to put them on or there may be a depression on the surface of the casting, or a cavity inside which will never be found until the machine work is done upon it.

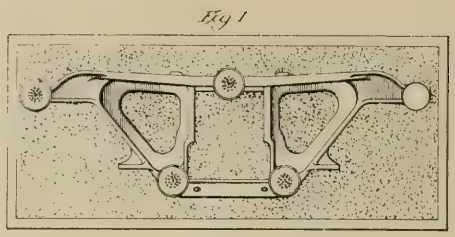
Robert F. Lamont of Chicago, Ill., has recently patented a method of eliminating risers on castings and describes same as follows:

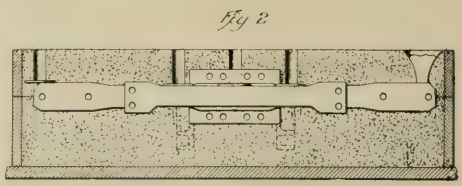
"It is, of course, necessary in order to prevent the occlusion of gases within the molten metal and the consequent weakening of the casting that free exit for the gases should be provided. This object has not hitherto been completely obtained in practice because in order to prevent the waste of metal and also the increased cost of removing the sprue or riser from the casting it has been customary to restrict both the number and area of the escape apertures as much as possible consistent with a fairly free vent for the occluded gases.

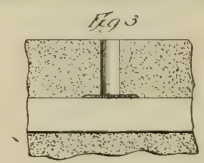
My invention proceeds upon the theory of providing adequate and ample escape for the gases and this I do by making the vent of practically uniform cross-section from end to end and then embedding in the wall of the mold at the inner end of the escape opening a perforated body of silicious material, the area of the perforations being adequate to permit the free escape of the gases, while the material constituting the perforated body coming in contact with the hot metal will chill the latter and prevent its rise within the cavity.

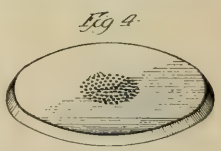
Therefore one of the objects of my invention is the provision of means whereby castings may be made in properly vented molds without the formation of risers.

In carrying out my method I prepare the mold which is to receive the casting, providing a liberal number of vent holes therein. These vent holes are then covered at their inside









ends with a perforated body of silicious material. These openings permit the escape of the gases but when the molten metal reaches the vent it contacts the area of cold material and is chilled or "freezes" without any portion thereof rising into the vent hole. After the casting is sufficiently hardened or set it is removed from the sand and it will be found that the perforated body, being preferably composed of core compound, has practically disintegrated and the casting is left substantially smooth and without the usual riser which would have to be removed by sawing or other means. As will be seen, by my novel means, the molds are well vented and the loss in metal and the cost of removing the risers is eliminated.

I have shown in the accompanying drawings the application of my novel method and apparatus to a mold for forming cast steel side frames, but it will be understood that it may be applied to the production of castings in general.

While my invention is adapted for use in the manufacture of small castings, it is also particularly advantageous when applied to the manufacture of large castings; that is, castings weighing in some instances many tons, and which may be of such design that if vented and a riser formed at the proper location in the mold for the most advantageous results it will be impossible or very difficult to remove the riser after the casting is formed. As will

be understood, these risers on large castings contain a large amount of metal and must necessarily be sawed from the casting and unless the casting can be placed in the saw the removal of the riser is difficult. Therefore my invention can be applied to the manufacture of such castings in a most advantageous manner; that is, the mold may be vented at its proper points to secure the best results and the risers formed where they can be easily removed."

A Large Installation of Steel Racks.

What is perhaps one of the largest installations of steel racks has just been made by the Johnston Harvester Company in their plant at Batavia, N. Y., and will be used for the storage of their many and various patterns. This equipment, consisting of 72 units length, (360 Lin. ft.) was made by the Berger Manufacturing Company in their works at Canton, Ohio.

Some idea of the size of the installation may be gathered from the fact that each one of these 72 units is 40 inches deep, 60 inches wide and 11 feet 6 inches high, giving each unit a shelf area of 200 square feet, and a total area for the entire system of 14,400 square feet.

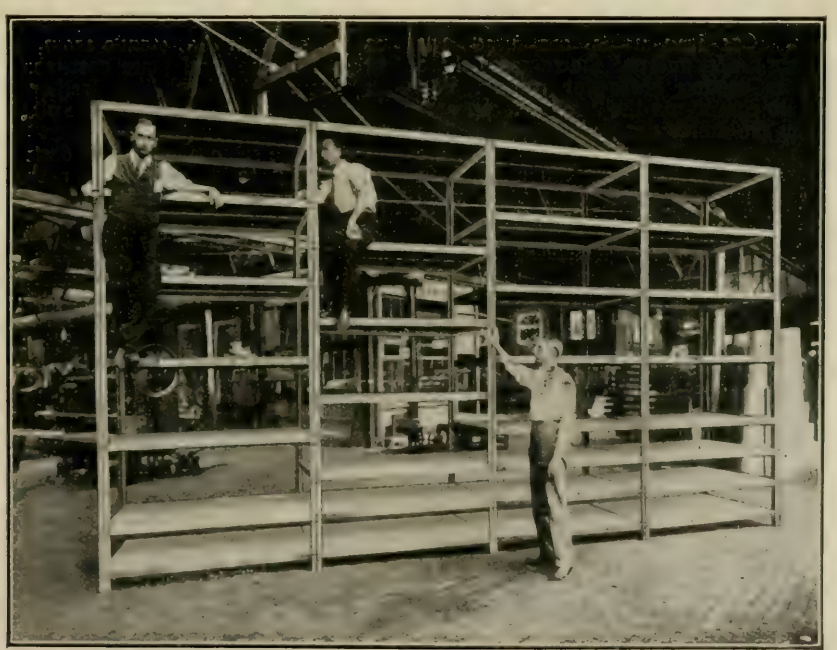
The stipulations were that each shelf should be capable of bearing a load of 250 lbs. making a total capacity of 3,000 lbs., for each unit. This would mean that the entire system would be capable of sustaining a grand total of 216,000 lbs.

Large as these figures are, the system in reality develops a capacity far exceeding these stipulations—much more than they will ever be called upon to sustain.

This large equipment of steel racks for pattern storage shows a decided trend towards better shop and factory equipment. Steel bins, shelving and racks have indeed many conspicuous advantages over the old wooden construction, being proof against fire and rodents, they cannot rot as wooden shelving is almost certain to do, and in addition, they afford much greater storage capacity, for the same floor area.

With these advantages it is small wonder that steel bins, shelving, and racks are coming rapidly to be considered a most essential part of the equipment of the modern shop and factory.

In addition to this large order of pattern shelving mentioned The Berger Manufacturing Company have also furnished the Johnston Harvester Company 35 hoppers and 18 core oven doors for use in their foundry.



Steel Racks Installed by the Berger Mfg. Co. of Canton, Ohio for Holding Patterns at the Works of the Johnson Harvester Co., Batavia, N. Y.

Questions and Answers.

QUESTION No. 1074. We are mailing you a sample of a casting of a brass handle which we find difficult to make. The prongs of the handle must be bent over, after being slotted. and the mixture we are using breaks when we do this. We have tried several mixtures without success. Can you suggest a mixture of yellow brass that will do it?

Answer. The mixture you are using contains lead which causes the brittleness. If you leave the lead out you will have no difficulty. The following mixture will give good results:

Copper	70 lbs.
Zinc	30 lbs.
Aluminum	2 oz.

QUESTION No. 1075. I am troubled with my nickel plated work pitting. What I am plating is cheap, cast-iron shears and when buffed the pits show badly. I have thrown away the old solution, thinking it might be the cause, and then made up a new one from double nickel salts. The result is better but not satisfactory. I have never used anything but double nickel salts in my solution and have usually found that there would be no pitting. What can be used for stopping the pitting?

Answer. You will find boracic acid excellent for stopping the pitting. Use about 5 oz. of boracic acid to each gallon of nickel solution. You will have to boil the solution to dissolve the boracic acid it is but slightly soluble when cold. It is very efficacious in stopping the pitting of steel work.

QUESTION No. 1077. What kind of molds are used for casting pure nickel to be rolled, and should there be any particular lining on the mold?

Answer. Cast-iron molds are used for casting pure nickel and are the same as those employed in casting brass for rolling. You will need no coating on the mold. except, perhaps, when the molds are new, to rub a little dry graphite on the face. This will obviate the sticking of the nickel to the mold. You will have to have the molds rather hot when the nickel is poured in as it is very apt to chill.

QUESTION No. 1078. What would you recommend for a French-gray on silver plated mesh bags?

Answer. You will find nothing more simple and satisfactory for this work than liver of sulphur. Use 3 oz. of liver of sulphur to 1 gallon of water and use quite warm, but not boiling. A temperature of about 120-150 degrees F. is quite satisfactory. First give your mesh bags a fairly heavy coating of silver (a flash coating will not do as it will come off in the liver of sulphur dip) and then oxidize in the liver of sulphur dip. Then scratch-brush and finally relieve with punice. The mesh bags should then be lacquered. The black produced by the liver of sulphur is quite tenacious and hangs to the silver well. This method is the one used more than any other for French-gray work as it is cheap, easy to work, does not fade, and wears remarkably well.

QUESTION No. 1079. Will you kindly advise me whether you know of any chemical process for case-hardening sheet copper? I know that copper has been hardened mechanically by rolling or drawing, but wish to know whether there is a chemical process which will case-harden the metal. I have reference particularly to sheet copper. So-called "case-hardened" sheet copper gaskets are found on the market and what I would like to know is, whether these gaskets are actually case-hardened like iron or steel.

Answer. As far as we know, copper has never been case-hardened. The same treatment that is applied to steel, that is by applying or heating in potassium cyanide, heating in bone, leather, or other substances employed for the purpose, does not have any effect on the copper and it is left as soft as before treatment. The only method of hardening copper is by rolling or drawing. There is a process of so-called case-hardening brass and coating the surface with pure tin and then bronze, which is, in reality, an alloying, by heating red hot so that the tin alloys with the copper and forms a hard skin on the metal. This process cannot very well be applied to sheet copper as it would change the color and be difficult to apply. It is seldom used and is difficult to apply uniformly. We have never heard of its being employed on sheet metals, but only castings. Bronze dies have occassionally been hardened in this manner.

QUESTION No. 1080. I have a hot cyanide copper solution that stands from 21 to 25 degrees Beaume' and plate cast-iron in it that has been tumbled bright in leather. The cast-iron is not cleaned at all before plating, but the hot copper solution is relied upon to clean and plate at the same time. Have done good work in from 7 to 10 minutes for the past two years, but now the solution will not clean the work well and gives off a gas, while the plating is going on, that is almost unbearable. I add more cyanide and the anodes coat over and the gas comes off worse. The anodes clean up very bright as soon as the work is taken out. If I add a good quantity of cyanide the anodes turn a slate color when they are not running. Have put nothing in the solution but cyanide for a year. What is the cause of the trouble?

Answer. There are two things the matter with your copper solution.

1. It is old and full of foreign and inert salts.
2. It is lacking in copper.

Hot copper solutions age very rapidly and the potassium cyanide is changed to cyanate and then to carbonate, both of which are more or less injurious when present in large quantities as they undoubtedly are in your solution. In the best regulated establishments

doing hot coppering, it is customary to throw away a certain proportion of the solution, at stated periods and replace with new. In this manner the solution is prevented from aging. We know of concerns that throw away some of their hot solutions every week. A pail or two, depending upon the size of the solution. Your solution is too old. We should either throw away all of it and make up new or a good portion of it, at least, and replenish with new. The copper, of course, can easily be added in the form of carbonate of copper. Hot solutions deposit copper so rapidly that the anodes do not feed the solution proportionately and carbonate of copper must be added from time to time to allow for it.

Question No. 1081. We are having trouble with our red brass and phosphor-bronze castings. The red brass castings always come dirty on the top. The phosphor-bronze castings seem to be blistering around the core. We are using all good metal. Can you give us a reason for this trouble and advise us how to overcome it?

Answer. Your red brass is apparently oxidized in melting and contains so much oxide (dross) that it flows in with the metal. We suggest the use of a small quantity of phosphor-tin or phosphor-copper for removing it. A *small* quantity only should be used as a larger amount will cause pin-holes in the casting when zinc is present in the metal as it is in your red brass. Add from 1 to 2 oz. only of the phosphor-tin or phosphor-copper as this is sufficient. Add when the metal is melted and while in the fire and then allow to remain a few minutes after stirring to act.

The difficulty with your phosphor-bronze may be the use of too much phosphorus as this will cause blowholes (which you call blisters) and the remedy is to use less phosphorus. It is a very common fault in making phosphor-bronze to use too much phosphorus. The amount of phosphorus contained in the mixture should not run over 0.25% and 0.10% is usually better. If zinc is present (it should not be used in a regular phosphor-bronze) then an extremely small quantity only can be used. The addition of phosphorus to the bronzes containing zinc causes pin-holes in the casting unless the amount is kept down to 0.01 or 0.02 per-cent (from 1 to 2 oz. of phosphor-tin or phosphor-copper).

Question No. 1082. I am having trouble with my nickel anodes. The surface seems to soften and layers of nickel will drop off. At the bottom, they seem to crumble away and sometimes will split at the sides. Please tell me what the trouble is.

Answer... Anodes that are not cleaned frequently will usually wear away unevenly, but we should say that there is a possibility of anodes having been poorly cast. Nickel anodes that have not been poured at the right heat frequntly show unevenness in structure which will result in the anodes wearing away unevenly. Anode makers rarely have this difficulty at the present time, but now and then an error will occur in casting with the result previously mentioned. It would be impossible to say positively that this was the trouble without actually seeing the anodes.

Question No. 1083. I am making some brass heaters that are to stand the test of 250 lbs. per sq. in. and some of them sweat and others are cracked. I would like to get a mixture which would stand the pressure. I have 400 on my hands now. The mixture I am usuing is 87% copper, 7% tin and 4% zinc. I would like to know what the trouble is.

Answer. Possibly your castings are not sufficiently thick for the purpose and advise investigating this matter. We also suggest the addition of lead to your mixture and using less zinc. The more zinc there is in a mixture, the dirtier the castings as zinc always produces dross. You must bear in mind the only use of the zinc is to produce sound castings and also cheapen the mixture, but as you do not desire to cheapen the mixture, then you can add less without any difficulty. A less quantity will give you all the soundness that can be obtained in a greater quantity. We suggest the following:

Copper	89%
Tin	7%
Lead	2%
Zinc	2%

The lead is useful in metal to stand pressure as it seems to "fill up the pores" and prevent leakage. The use of about 1 or 2 oz. of phosphor-tin or phosphor-copper in the mixture (used after the metal is melted) will act benefically and give a cleaner metal. Use no greater quantity, however, or it will cause other difficulties in the way of pin-holes.

Question No. 1084. I wish to deposit silver to a thickness of 3/64 of an inch and retain a smooth surface. Can it be done?

Answer. This will depend upon the character of the work, but you will not be able to produce a very smooth surface without a final cutting down and buffing. If you take the article out and scratch-brush it from time to time, as you will have to do, in order to present the formation of a rough surface, you will be able to deposit the silver to the thickness you desire. If, however, you cannot do this, then you will have a rough deposit at the end and one that will not be particularly good. The regular silver plating solution containing 3 oz. of silver and 4 oz. of free cyanide to the gallon is recommended.

Question No. 1089. Are the aluminum and zinc mixtures used to any extent for automobile work? We have heard that they were seldom employed.

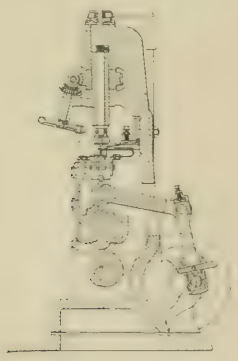
Answer. Owing to the fact that the aluminum and zinc alloys are apt to crack in the mold or break in service through the opening of unseen cracks which passed inspection, the aluminum and copper alloys are now employed almost exclusively by the best makers. The aluminum and zinc mixtures, while stronger, are treacherous. They can, however, be employed for small parts without difficulty.

Patent Abstracts.

1,008,845, & 1,008,970, Nov. 14, 1911. DENTAL FILLING MATERIAL. Adolphus G. Meier of St. Louis, Mo. Dental filling is usually a very thin foil of pure gold. When compressed in a tooth cavity, it unites to a comparatively solid mass. While satisfactory, the expense of the gold is an obstacle. The present invention is for the purpose of econ-

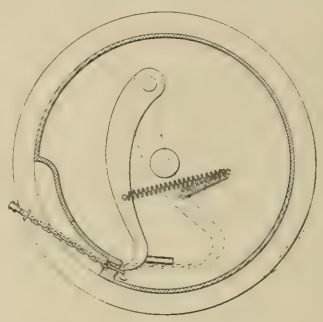
omizing in gold. A sheet of tin or a tin alloy is soldered between two sheets of pure gold and the compound plate thus made is rolled down to the required thickness. The uniting of the gold with the tin or tin alloy before rolling is claimed as the essential feature of the patent as it then has the properties of the pure gold in the necessary degree.

1,008,442, Nov. 14, 1911. MACHINE FOR FORMING WIRE DRAWING DIES OR PLATES. Nicholas King Turnbull of Manchester, England. The machine is for the purpose of swaging the die openings in wire drawing plates or dies. The punch used for



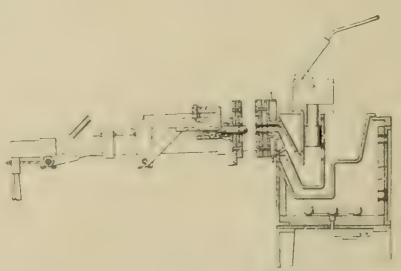
swaging the hole in the die is given a vibratory motion while the operation is going on. A hammering process is , therefore, obtained which performs the desired results. Square or other shaped holes may be swaged by the use of suitable shaped punches.

1,008,950, Nov. 14, 1911. WIRE DRAWING BLOCK. Elbert H. Carroll, of Worcester, Mass. Assignor to the Morgan Construction Co., of the same city. A wire block with a flexible connection between the rotating block and the wire gripping mechanism, which will



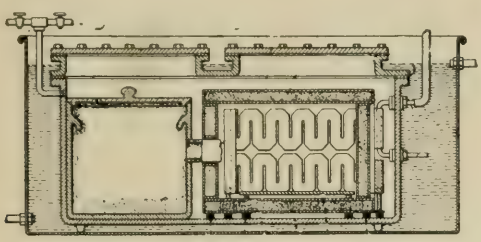
immediately be drawn in a shield or protecting rim upon the top of the block whenever the strain upon the flexible connection is relieved. This relieving may be caused by the breakage of a wire while being drawn. By means of mechanism, the block is then stopped as the driving power is disconnected. The device, therefore, is a safety one both for the operator and the mechanism.

1,009,107, Nov. 21, 1911. & 1,009,263, Nov. 21, 1911. CASTING MACHINE. Joseph Soss of Brooklyn, N. Y. A machine for making die castings. The metal is melted in a pot heated by gas and then forced into the mold by means of a plunger operated by hand. The feature of the patent is in the manner of attaching



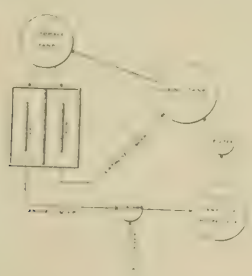
and releasing the mold so that it is not injured and perfect castings result. The castings of low melting metals, such as antimonial-lead, britannia-metal, and the harder zinc alloys can only be cast. In other words, the process is applicable only to metals and alloys that can be melted in the pot.

1,009,625, Nov. 21, 1911. ELECTRIC FURNACE. William C. Arsem of Schenectady, N. Y., Assignor to The General Electric Co. of the same city. An electric furnace used for the fractional distillation of metals. They are distilled while in a vacuum and the essential features of the furnace lie in the means for



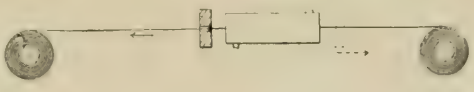
producing this vacuum and maintaining it while distillation is going on. Means are also had for distilling in any desired gases instead of a vacuum. The furnace is heated by graphite resistance members. Gold and silver may be separated from one another and also from platinum by means of the furnace.

1,007,388, Oct. 31, 1911. ELECTROLYTIC METHOD OF REFINING IRON. Alexander S. Ramage of Buffalo, N. Y. A method of refining iron by electrodeposition so that a metal free from carbon is obtained. Scrap metals of the cheapest kind are used. Sheet lead anodes are used and cathodes of sheet



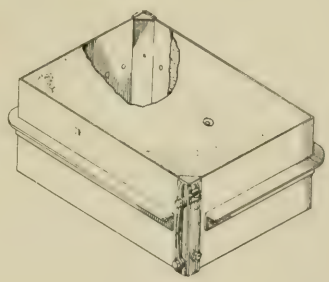
iron. The solution is composed of sulphate of iron and is agitated in order to use a higher current density. The feature of the process is in the method of distributing and using the electrolyte as indicated by the sketch herewith shown.

1,008,808, Nov. 14, 1911. METHOD OF DRAWING FINE WIRES OF REFRACTORY METALS. Karl Farkas of Glen Ridge, N. J. The process is applied more particularly to the drawing of tungsten wire used in electric light filaments. In the ordinary method of making, the wire is apt to be irregular and lack uniformity in diameter. The invention consists in heating the wire



electrically in a chamber before it passes to the die. It is then in a soft and ductile condition and may be maintained so with great uniformity. If necessary, the operations may be repeated to obtain a very exact diameter.

1,007,462, Oct. 31, 1911. MOLD JACKET. Lemuel L. Long of Toledo, Ohio. The jacket is used for molds made by a snap-flask. The inventor states that such flasks vary in size, either warping or shrinking when in use, and



the mold thus lacks uniformity. The mold jacket is made adjustable so as to conform readily to such inequalities in the sand mold. It is capable of being adjusted to meet the conditions.

1,008,807, Nov. 14, 1911. METALLIC FILAMENTS FOR ELECTRIC LAMPS. Karl Farkas of New York, N. Y. Assignor of one-half to Guy V. Williams of the same city. A process of making lamp filaments of the rare metals such as tungsten or tantalum. The ordinary method is to make a mass of the tungsten powder with glue or other organic binder and then heat to fuse the metal after the mass has been drawn into wire. The present invention relates to the employment of oxide of tungsten in connection with the metal in order to remove the carbon present in the binder. This is accomplished by the carbon reducing the oxide of tungsten to metal and being oxidized at the same time to gas.

Trade Items.

The Traut & Hine Mfg. Co., of New Britain, Conn., manufacturers of buckles, jewelry and metal novelties are to commence the manufacture of safety razors.

The plant of the Southern Brass Bed Company at New Orleans, La., manufacturers of metal beds, was recently damaged by fire to the extent of $25,000.

The factory of the Manistee Watch Co., at Manistee, Mich., watch manufacturers, has been temporarily closed on account of the affairs of the company being in the court About seventy hands have been laid off.

A new plant is to be erected by the Champion Spark Plug Company in Toledo, Ohio, and ground has already been broken for it. It will be located on Upton and Avondale Aves. The manufacture of automobile accessories is carried on.

The Le Grand Bronze Company, formerly of Plainfield, N. J., are now located in their new works at 65-69 East 46th. St., Bayonne, N. J., and are carrying on the manufacture of the "Le Grand" bronzes in ingots, billets and castings. F. L. Montgomery is manager of the company.

The new shops of the Central of Georgia Railroad at Macon, Go., are supplied with a new brass foundry in which Steele-Harvey brass melting furnaces are installed. They are also equipped with a pressure blower and ladle heater made by the Monarch Engineering & Mfg. Co., of Baltimore, Md., manufacturers of the Steele-Harvey furnaces.

The Artistic Bronze Co., has moved its plant from South Norwalk, Conn., to Bridgeport, Conn., where its new plant is situated. This plant has been under construction for some time and is situated on Fairfield Ave., near Burr Road. A new brass foundry and plating plant has been installed and facilities for manufacturing has been greatly increased. The manufacture of cabinet hardware is carried on.

Pattern-makers, brass founders and iron founders should certainly investigate the "Crown" Leather Fillet, made by the Page Belting Company of Concord, N. H. This fillet is the very best made and is manufactured from leather suitable for the purpose. The leather is soft and flexible and a fine feather edge is put upon it so that in use upon the pattern, it will lie close to the surface and not leave a groove or ridge on the casting. The softness is such that it will bend to any desired angle. Pattern-makers have realized that there is no material equal to leather for fillets, and in many instances patterns are left without them, on account of lack of a suitable material, when they should be put on. The advertisement of the Page Belting Co., should be watched as unique plans are being drawn up for selling it.

A plating plant is to be installed by the Cyclone Woven Wire Fence Co., of Cleveland, Ohio.

The R. M. Babbitt Brass Foundry Co., of Chicago, Ill., is to retire from business and have filed notice of dissolution.

The Art Brass & Metal Works, Louisville, Ky., has installed some new brass working machinery in its plant in that city. This company recently took over the Apex Mfg. Co., of that city.

The brass foundry conducted by Charles Kaufman, Oshkosh, Wis., manufacturer of boat, launch and other marine hardware has been sold and he will discontiue this part of his business.

The name of the Millett Brass Company of Springfield, Mass., has been changed to the Millett & Hardy Company. The manufacture of brass, bronze and aluminum castings is carried on as before and there has been no change in any way except in the name. There has been no change in management.

The Brown Speedometer Co., has been organized in New Britain, Conn., to manufacture speedometers, and with a capital stock of $200,000. The officers of the company are: Charles Glover, president; Charles A. Earle, vice-president, and George P. Spear, secretary. Wilbur C. Brown of Porchester, N. Y., is the treasurer of the company.

E. T. Wood of Lyndonville, Vt., the well known brass founder, has acquired an interest in the Springfield Brass Foundry of Springfield, Vt., and will conduct it in the manufacture of brass castings. Mr. Wood is general manager of the plant and will conduct it separately from his own in Lyndonville. The officers of the Springfield Brass Foundry are: E. T. Wood, president and general manager; F. B. Gill, secretary and treasurer; and P. E. Luther, superintendent. A jobbing brass foundry is carried on.

The Bontempi Rust Proofing Co., is now located in their new plant in Bridgeport, Conn., and operations have already commenced. This plant is situated at the corner of Water and Thomas Sts., and large furnaces have been installed for treating all classes of material. The process employed by the company is one which they evolved and patented a number of years ago, and has proven exceptionally satisfactory. By it cast-iron, malleable-iron, steel, wrought-iron or any other classes of iron or steel goods are given a black finish that is not only ornamental but thoroughly rust-proof. It is not skin deep but penetrates the metal to a depth sufficient to protect it. The company will gladly finish samples for the trade and carry jobbing work as well as install furnaces. The New York Office of the company is at Trinity Bldg., 111 Broadway.

The Sterling Brass Company has been incorporated in Cleveland, Ohio with a capital stock of $35,000 to manufacture plumbers' brass goods. A new plant is being erected at 47th. St., and St. Clair Ave.

The H. Mueller Mfg. Co., of Decatur, Ill., one of the largest manufacturers of plumbers' brass goods in the United States, recently decided to establish a Canadian factory. It is now stated that the plant will be located in Port Arthur, Ont.

The Brown Machine Co., of New Glasgow, Nova Scotia have recently installed a large oil melting furnace for melting scrap, chips and other kinds of bulky material. The furnace will take a charge of 665 lbs. and it is stated that the oil consumption is 1½ gallons to 100lbs. of metal melted.

The Art Hardware & Mfg., Co., Seattle, Wash., has moved from 2107 Western Ave., to its new plant at 928 First Ave., South, in that city. This company now has a modern plant for the manufacture of builders' hardware and make a specialty of the fine grades of art work. Their business has increased over 700 per-cent during the year 1911.

The Electrical Alloy Company of Morristown, N. J., manufacture pure nickel in the form of ribbon and wire. They also manufacture a very complete line of resistance materials of special alloys, such as nickel and chromium, nickel and manganese alloys, German-silvers, and cupro-nickels. The wires they manufacture have a high melting point and high electrical resistance. They also make special wires for spark plugs used on automobiles.

The Norton Company, Worcester, Mass., manufacturers of abrasive wheels of all kinds and grinding machinery, have recently brought out a new material for grinding. It is called "Crystolon" and is made in the company's plant in Chippawa, Canada by means of the electric furnace. This material is particular adapted for the grinding of brass, bronze and copper alloys as the grains are more brittle than emery and break down more readily, giving the sharp surface so much desired in the grinding of these metals. It has proven particularly efficient on these metals.

The United States Electrogalvanizing Co., 1 Park Ave., Brooklyn, N. Y., manufacturers of automatic plating machines, announce that they are prepared to pay a reward for any information leading to the disclosure of parties using their process or machines without authorization from them. This company manufactures automatic plating machines for all kinds of electroplating, and which takes the goods in the rough condition and delivers them plated and dried without requiring skilled labor. The machine does the work. They also carry on electrogalvanizing and install plants for this purpose. A large number of their machines are now in use for electrogalvanizing and have proved exceptionally satisfactory.

The capital stock of the Kokomo Brass Works of Kokomo, Ind., has been increased from $50,000 to $100,000.

A site of four acres has been obtained by the White Adding Machine in South Nashville, Tenn., upon which an extensive plant is to be erected for the manufacture of computing machines. This company was recently organized with a capital stock of $400,000.

The Houser Mfg. Co., 644 East Jefferson St., Louisville, Ky., manufacturers of dental supplies and brass fittings, has recently installed a complete nickel plating plant. This company recently moved to Louisville and will shortly add on to their plant by the erection of a new building.

The Remy Electric Co., of Anderson, Ind., manufacturers of magnetos and electric specialties, have purchased the plant of the R. C. Peters Company at Grand Rapids, Mich., manufacturers of electric head-lights and is moving it to Anderson. A new plant, 60x120 feet is being built for this new department. The manufacture of electric headlights for automobiles is carried on.

The Detroit Foundry Supply Co., Detroit, Mich., and branches at Windsor, Ont., and St. Paul, Minn., have recently issued an extensive catalouge of platers' and polishers supplies. This catalogue is compiled in an excellent manner and comprises 184 pages with a large number of illustrations. In it may be found everything that a plater and polisher may need and many articles not usually found in catalogues of this kind are described.

The Pratt & Cady Co., of Hartford, Conn., valve manufacturers, have severed their connection with the Fairbanks Company of New York City, who have acted as selling agents for them for the past 8 years, and will now and henceforth sell their own product. George L. Spence has been made sales-manager and a large number of stores have been opened in the large cities throughout the country. At a recent meeting, John Spencer Camp resigned as president, and George W. Hayden was elected in his place. Mr. Hayden has been connected with the company for about two years and was formerly connected with the Crane Co., of Chicago.

The United States Chemical Co., of Cleveland, Ohio, the well known manufacturers of electroplaters' chemicals, have brought out on the market a new material for producing black nickel deposits. Samples of work will be plated with this deposit free of charge and they solicit the opportunity of doing work for inspection. They state that these black nickel salts will produce a finish as black as "black velvet in twilight" and can be used on name plates, hardware, gas fixtures, casket trimmings and lamps, or any other class of wark where a black finish is desired. The deposit is a beautiful black and is superior to oxidized copper finishes. They guarantee results and solicit inquiries from anyone who desires a black finish.

The Canadian Pacific R. R., is to build railroad shops in Calgary, Alberta, which are to cost $2,250,000 and, it is stated, will employ 2,000 hands.

A plant is to be established in Los Angeles, Cal., by the S. & M. Lamp Co., for the manufacture of lamps and automobile radiators. The property has been leased and the equipment is shortly to be installed.

The Grasselli Chemical Co., of Cleveland, Ohio, manufacturer of chemicals and spelter, with branch works in various cities in the United States, is to build a plant in Hamilton, Ont., Canada.

The Imperial Clock Co., is to proceed with the equipment of its new plant in St. Louis, Mo. This was delayed for some time by litigation but which is now settled satisfactorily. The present location is at Granite City, Ill., and the manufacture of electric clocks is carried on.

The Waynesboro Metal & Foundry Co., has been incorporated at Waynesboro, Pa., with a capital stock of $50,000 by F. D. Miller C. V. Moore, George H. Armacast, George B. Beaver and John C. Benedict of Westminister, Md. The manufacture of iron, steel and brass castings is to be carried on. George H. Armacast is the treasurer.

The Koken Barber Supply Co., St. Louis, Mo., manufacturers of barbers' chairs and accessories, are having plans drawn for a new six story building for manufacturing and which is to cost $200,000. It will be 110x145 feet and it is expected that the capacity of the plant will be doubled. This company is the largest of its kind and are extensive electroplaters as portions of their goods are nickel plated.

The Canadian Hanson & Van Winkle Co., Ltd., has been organized in Toronto, Canada, to take over the Canadian business of the Hanson & Van Winkle Co., of Newark, N. J., and the Rupert G. Bruce Co., Ltd., of that city. A site has been purchased in that city and the erection of a new plant begun. The manufacture of a complete line of plating and polishing supplies and equipment is to be carried on, and a foundry for the production of nickel, brass, copper, bronze and zinc anodes is to be installed. Foundry and mill supplies will also be handled.

Voland & Sons of New Rochelle, N. Y., the well known manufacturers of fine scales and balances, have just issued a new catalogue of the precision balances and weights that they manufacture. This is called Catalogue F and will be gladly sent free to those who are interested. In it is a complete list of all the balances and scales which they manufacture. Platers, brass manufacturers, chemists, silversmiths and all others who have occasion for fine and accurate weighing should have a copy for reference. Voland & Sons manufacture only the highest grade of scales and balances and their goods are now extensively used in all parts of the United States and Canada.

The Mebane Iron Bed Co., Mebane, N. C. manufacturers of metal beds, is to add considerable new equipment to its plant.

The Sibley Stove Co., has been organized in South Bend, Ind., with a capital stock of $50,000 to manufacture a new pattern gas stove.

The Main Brass & Mfg. Co., has been incorporated in Los Angeles, Cal., with a capital stock of $25,000. The incorporators are Herbert, Charles and Henry Overton, together with Lawrence Macomber.

Wilson S. Yerger, 1226 North Howard St., Philadelphia, Pa., consulting chemist and engineering analyst, makes a specialty of the testing and analysis of all metals and alloys. Brass, aluminum, white-metals and plating solutions are given special attention and prompt and accurate service is given. Brass founders and electroplaters, who need services of a chemist, should obtain his terms.

The Taunton-New Bedford Copper Co., are to erect a new building at their New Bedford Works in which a complete new rolling mill plant, with engine and boiler, will be installed. This company is one of the largest manufacturers of sheet copper and wire in the United States. They also manufacture yellow metal sheathing and specialties in this metal and copper. They have the largest sheet copper mill in the United States.

The Hanson & Van Winkle Co., of Newark, N. J., manufacturers of plating and polishing supplies and equipment, are sending out to the trade, their new Bulletin No. 119 describing the lacquers which they manufacture. They now make many different grades of lacquers adapted for all purposes. The Bulletin is of particular interest as it contains information upon the use of lacquers. It will be sent upon request.

Walter Dow, Mansfield, Ohio, is now manufacturing a complete line of buffing and polishing machinery and electroplating supplies of all descriptions. His familiarity with the trade enables him to manufacture a line of materials adapted for any class of work. A specialty is made of polishing wheels, buffs, rouge, tripoli-composition, and Vienna-lime composition. Opportunity should be given him to quote when purchases of plating or polishing supplies are to be made.

Thomas Watts Coslett, Birmingham, England, inventor and patentee of "Coslettizing", the process for placing a rust proof coating upon iron or steel and, at the same time, giving it a black color, announces to the trade that A. E. Flavell no longer represents him in the United States. Those interested in the process should take up the subject with Mr. Coslett direct as he will be pleased to give full particulars upon request. This process is so simple that it appeals to manufacturers, consists in boiling the iron or steel in a phosphate solution. It is one of the few processes that will produce a black, rust-proof coating on hardened steel goods.

The plant of the Guelph Stove Co., Guelph, Ont., Canada is to be enlarged.

The Toledo Metal Spinning Co., has been incorporated in Toledo, Ohio with a capital-stock of $10,000.

The International Acheson Graphite Co., of Niagara Falls, N. Y., manufacturers of artificial graphite, have been awarded a grand prize by the Turin Exposition at Turin, Italy.

The International Metal Polish Co., has been incorporated in Indianapolis, Ind., to manufacture metal polishes and is erecting a two-story factory at a cost of $25,000.

The Waterbury Metal Products Co., of Waterbury, Conn., has been incorporated for the manufacture of metal novelties. The incorporators are J. M. Burrall, John B. Wallace, Jr., and Fred H. Goppelt, Jr., of Waterbury.

The Modern Specialties Mfg. Co., is now located in its new factory in Goshen, Ind., where it moved from Milwaukee, Wis. The new factory contains 25,000 feet of floor space, and the plant is equipped with the most modern appliances. Hardware specialties are manufactured.

J. H. Williams & Co., 150 Hamilton Ave., Brooklyn, N. Y., the well known manufacturers of drop forged hardware, recently purchased a tract of land, 60 acres in extent in Buffalo, N. Y., and will, in the near future, remove its plant to that city. It is stated that the new plant is to cost $1,000,000. The company carry on polishing and plating.

The contract for the new factory of the H. A. Matthews Mfg. Co., of Seymour, Conn., has been let and will be 60 feet square, two stories high. The plant of this company was recently destroyed by fire and the new plant is to replace it. The manufacture of stove trimmings and similar hardware is carried on. A new nickel plating plant is to be installed.

The Standard Silver Co., 33-41 Hayter St., Toronto, Canada, manufacturers of silver plated hollow-ware, are now building a new five story, concrete factory to cost, when completed, about $90,000. It is proposed to make this new plant an ideal one for manufacture of silver plated wares. The building is being handled by their construction department who will be interested in modern equipment applicable to it.

The Rojas Electro Chemical Co., 516 West 25th. St., New York City, was recently organized to market the inventions of F. A. Rojas in the shape of solutions for the coloring of metals. This coloring has been called "Electrochroma" by the inventor and the color desired is simply plated on in a solution. The time required for producing a suitable and extremely permanent color, as well as hard and durable, is about one minute. This process is one of the remarkable advances in the coloring of metals. Information will be gladly sent to those interested and samples will be done free of charge.

The Superior Metal Products Co., of Elyria, Ohio is moving to its new plant. Some additional equipment is yet to be purchased.

The Cossitt Company of Brockville, Ont., Canada, manufacturer of scales, is building an addition to their plant in that city.

O. D. Shorb, Port Townsend, Wash., has commenced the manufacture of jewelry and has installed furnaces and rolls for gold melting and rolling.

The Waterbury Brass Co., of Waterbury, Conn., manufacturers of brass sheet, rod and wire and small brass goods, are building a new casting shop on West Main St.

The Lumen Bearing Co., of Buffalo, N. Y., and Toronto, Canada, brass founders, are sending out their "Treatise No. 6" on Zinc. This is a booklet giving much data on zinc and will be sent to those who desire it. The previous numbers of the series have been on other metals.

A new stove plant is to be erected by Isaac A. Sheppard & Co.,stove manufacturers, Philadelphia, Pa. Seven acres of land have been obtained for this purpose on Erie Ave., and Sepviva St. The manufacturer of stoves is to be carried on and the most modern equipment is to be installed.

The Monarch Metal Weather Strip Co., of St. Louis, Mo., is to build a new plant on Forest Park Boulevard in that city. The present plant is at 3949 Forest Park Boulevard and zinc, copper, brass and steel weather strips are manufactured. It is expected that the new plant will be in operation by January 1st. The company has been in existence about four years.

F. A. Tolhurst, vice-president of the Tolhurst Machine Co., of Troy, N. Y., manufacturers of centrifugal machines for drying out metal goods, has recently been granted a basic patent on the method of drying and brightening small metal goods by means of hot air. This process seems to cover the use of hot air in connection with centrifugal action, which process has lately been attracting so much attention. Various patents have, heretofore, been issued to different persons for specific mechanical devices for accomplishing this result, but their use will evidently contitute an infringement of the Tolhurst process.

Personal.

James G. Brown, formerly foreman of the plating department of the Holmes & Edwards Silver Co., Bridgeport, Conn., is now associated with Thomas S. Stretch, 194 Hester St., New York City, jobbing electroplater.

John G. Rote, factory manager of the Gillette Safety Razor Co., Boston, Mass., has sold his entire interest in the company and resigned as manager in charge of the manufacturing. The resignation is to take effect January 1st.

Current Metal and Supply Prices.

These Prices are net and are for moderate quantities. Smaller quantities command higher prices. Prices subject to fluctuation.

Acetone, pure, 98-99%	lb.	.22
Acid, Acetic, pure, 30%	lb.	.07
Acid, Arsenious (White Arsenic)	lb.	.20
Acid, Benzoic	lb.	.55
Acid, Boracic (Boric), pure	lb.	.12
Acid, Hydrochloric, see Acid, Muriatic.		
Acid, Hydrofluoric, 30%	lb.	.04
Acid, Hydrofluoric, 50%	lb.	.10
Acid, Muriatic, 20°	lb.	.02
Acid, Muriatic, c. p., 20°	lb.	.07
Acid, Nitric, 38°	lb.	.05⅝
Acid, Nitric, 40°	lb.	.05⅞
Acid, Nitric, 42°	lb.	.06¼
Acid, Nitric, c. p.	lb.	.08
Acid, Sulphuric, 66°	lb.	.01¾
Acid, Sulphuric, c. p.	lb.	.06
Alcohol, Wood	gal.	.50
Alcohol, Denatured	gal.	.55
Alum	lb.	.04
Aluminum, Metallic, in Ingots	lb.	.19½
Ammonium Sulphate	lb.	.07
Aqua-Fortis, see Acid, Nitric.		
Ammonia Water (Aqua-Ammonia), 20°	lb.	.04¾
Ammonia Water (Aqua-Ammonia), 26°	lb.	.06¼
Ammonia Water, c. p.	lb.	.08
Ammonium Carbonate, lump	lb.	.15
Ammonium Chloride (Sal-Ammoniac)	lb.	.12
Ammonium Hydrosulphuret	lb.	.30
Ammonium Sulphate	lb.	.07
Ammonium Suphocyanate	lb.	.50
Amyl Acetate	gal.	3.00
Antimony	lb.	.07¾
Arsenic, Metallic	lb.	.15
Arsenic, White (Acid Arsenious)	lb.	.20
Argols, White (Cream of Tartar)	lb.	.31
Asphaltum, Commercial	lb.	.05
Asphaltum, Egyptian (Bitumen)	lb.	.30
Benzine	gal.	.15
Benzol, Pure	gal.	.75
Bismuth, Metallic	lb.	2.00
Bitumen, see Asphaltum.		
Blue-Vitriol, see Copper Sulphate.		
Borax, Crystals or Powdered	lb.	.10
Borax Glass	lb.	.35
Cadmium, Metallic	lb.	.85
Carbon Bisulphide	lb.	.10
Calcium Carbonate (Precipitated Chalk)	lb	.10
Chrome-Green	lb.	.50
Copper, Lake, (carloads	lb.	.13¼
Copper, Lake (cask)	lb.	.13½
Copper, Electrolytic, (carload)	lb.	.13⅛
Copper, Electrolytic, (cask)	lb.	.13⅜
Copper, Casting, (carload)	lb.	.13
Copper Casting (cask)	lb.	.13⅛
Copper Acetate (Verdigris)	lb.	.35
Copper Carbonate, dry	lb.	.25
Copper Sulphate (Blue-Stone)	lb.	.09
Copperas, see Iron Sulphate.		
Corrosive Sublimate, see Mercury Bichloride.		
Cream-Tartar, see Potassium Bitartarate.		
Cryolite	lb.	.12
Cyanide, see Potassium Cyanide.		
Dextrin	lb.	.15
Emery Flour	lb.	.04
Emery, F F & F F F	lb.	.03
Flint, powdered	lb.	.01
Fluor-Spar	lb.	.01¼
Fusel-Oil	gal.	3.00
Gold Chloride	dwt.	.60
Gum Copal	lb.	.30
Gum Guiacum	lb.	.26
Gum Mastic	lb.	.70
Gum Sandarac	lb.	.35
Gum Shellac, brown	lb.	.50
Gum Shellac, white	lb.	.60
Iron Perchloride	lb.	.25
Iron Sulphate (Copperas)	lb.	.05
Lead Acetate (Sugar of Lead)	lb.	.15
Lead, Pig	lb.	.04½
Lead, Red	lb.	.12
Lead, Yellow Oxide (Litharge)	lb.	.12
Liver of Sulphur, see Potassium Sulphide.		
Manganese, Ferro, 80%	lb.	.10
Manganese, Metallic, pure	lb.	.75
Magnesium, Metallic	lb.	1.50
Mercury Bichloride (Corrosive Sublimate)	lb.	.93
Mercury, Metallic (Quicksilver)	lb.	.46½
Mercury Nitrate	lb.	1.50
Mercury Oxide, yellow	lb.	1.80
Nickel and Ammonium Sulphate (Double Salts)	lb.	.08
Nickel Carbonate, dry	lb.	.60
Nickel Chloride	lb.	.50
Nickel Metallic	lb.	.45
Nickel Sulphate (Single Salts)	lb.	.12
Nitre (Saltpetre), see Potassium Nitrate.		
Oil of Vitriol, see Acid, Sulphuric.		
Paraffine	lb.	.15
Phosphorus, yellow	lb.	.40
Phosphorus, red	lb.	1.10
Pitch	lb.	.05
Plaster of Paris, Dental	bbl.	4.00
Platinum Chloride	oz.	25.00
Platinum Metallic	oz.	46.00
Potash-by-Alcohol, in sticks	lb.	.50
Potash, Caustic (Potassium Hydrate)	lb.	.08
Potassium Bichromate	lb.	.14
Potassium Bitartarate (Cream of Tartar)	lb.	.31
Potassium Carbonate (Pearlash)	lb.	.10
Potassium Chlorate	lb.	.15
Potassium Cyanide	lb.	.25
Potassium Iodide	lb.	2.25
Potassium Nitrate (Nitre or Saltpetre)	lb.	.10
Potassium Permanganate	lb.	.17
Potassium, Red Prussiate	lb.	.60
Potassium, Yellow Prussiate	lb.	.24
Potassium Sulphide (Liver of Sulphur)	lb.	.15
Potassium Sulphuret, see Potassium Sulphide.		
Potassium Sulphocyanate	lb.	.70
Pumice, Ground	lb.	.05
Quartz, Powdered	lb.	.01
Rosin, Yellow	lb.	.04
Sal-Ammoniac, see Ammonium Chloride.		
Sal-Soda, see Sodium Carbonate.		
Silver Chloride, dry	oz.	.75
Silver Cyanide	oz.	1.00
Silver, Fine	oz.	.55
Silver Nitrate, crystals	oz.	.50
Soda-Ash	lb.	.05
Sodium Biborate, see Borax.		
Sodium Bisulphite	lb.	.15
Sodium Carbonate (Sal-Soda), crystals	lb.	.02
Sodium Hydrate (Caustic Soda)	lb.	.05
Sodium Hydrate (Caustic Soda) by Alcohol (in sticks)	lb.	.45
Sodium Hyposulphite ("Hypo")	lb.	.04
Sodium Metallic	lb.	.90
Sodium Nitrate	lb.	.05
Sodium Phosphate	lb.	.09
Sodium Silicate (Water-Glass)	lb.	.04
Soot, Calcined	lb.	.15
Spelter, see Zinc.		
Sugar of Lead, see Lead Acetate.		
Sulphur (Brimstone) in lump	lb.	.05
Tin Chloride	lb.	.43
Tin, Metallic	lb.	.45¾
Turpentine, Venice	lb.	.35
Verdigris, see Copper Acetate.		
Water, Distilled	gal.	.15
Water-Glass, see Sodium Silicate.		
Wax, Beeswax, yellow	lb.	.45
Wax, Carnauba	lb.	.70
Whiting (Ground Chalk)	lb.	.02
Zinc Carbonate, dry	lb.	.19
Zinc Chloride	lb.	.12
Zinc, Sulphate	lb.	.06
Zinc, (spelter)	lb.	.06¾

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